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Forthcoming Events.

JULY 4 to 9.

Society of Chemical Industry:—Forty-sixth annual meeting to be held in Edinburgh.

JULY 5-8.

Institute of British Foundrymen.

Conference at Sheffield.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1926-27: Vincent C. Faulkner, "Thalassa," Carlton Avenue, Kenton, Middlesex.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office, 49, Wellington Street, London, W.C.2.
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Sheffield: T. R. Walker, 26, Castlewood Road, Fulwood, Sheffield.
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Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Welsh Engineers' and Founders' Association.

Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.

Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Progress in the Electric Furnace Industry.

With the return to a more normal outlook in the business world there has been a recrudescence of interest in the possibilities of the wider application of the electric furnace to metallurgical problems. After about 15 years of commercial operation much useful data has been established, and the electric furnace has definitely established itself as a useful melting unit for the manufacture of steel castings, "tool" steel—especially stainless—and repetition non-ferrous melting.

There is a natural endeavour to widen this field by the construction of larger and more economically operated units with the object of manufacturing ordinary mild steel at competitive cost. It is interesting to note that in recent times most of the orders placed in the world's markets have gone to a designer who gives very generous facilities for the rapid input of electric power, and who employs relatively high voltage for its operation. It can be safely stated that though this ensures all the economies to be associated with speed of operation, we are not at all sure that such a system operates beneficially on the resultant steel. We base our criticism on the grounds that in so instituting conditions for rapid melting, it happens that equally there has been created ideal conditions for the fixation of nitrogen. If this element enters the metal then the accicular structure, associated with iron nitride and typical of certain conditions of burnt steel may show itself. It is further realised that there is a serious waste of time in the hand charging of large (10 to 30 ton) furnaces, and it has been proposed by a German designer to remove completely the roof by a sliding motion for the rapid filling of the furnace. Providing that refractory material capable of withstanding such drastic treatment can be found the system appeals to us, but we imagine that the final solution will be found to consist of one of the standardised charging machines, such as forms part of the normal equipment of the open-hearth plant, together with a system of powdered coal, oil or gas heating for use during charging. After tapping an electric furnace the residual heat is often insufficient for properly effecting a major repair, and this is either chanced or effected by arcing on some carbon material. Here we feel that auxiliary fuel would be of outstanding advantage.

Another possible solution is the part utilisation of the purest type of cupola metal, the rest of the charge to consist of steel scrap and iron ore or its equivalent. No doubt this would give poor slag conditions, but at least a type best able to support the high voltage which must now be associated with the latest practice.

The modern induction furnace, which is very unlike the models of 15 years ago, is making commendable progress. It is already firmly established as an efficient melter for non-ferrous materials, and is gaining ground in the domain of steel.

So far as the ironfoundry is concerned, we anticipate that its proved utility for making high-grade malleable castings will extend to the field of high-grade grey iron. From the result of both British and German researches alloys have been made with tests showing at a minimum three times those which one associated with cast iron two decades ago, and a *sine qua non* is apparently an intense superheating of the liquid metal followed by a heat treatment. Here apparently is a legitimate field for the extended use of the electric furnace, which is of intense interest to so many of our readers.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Growth of Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In your issue of June 23, the Paper by Dr. J. H. Andrews gives an excellent *résumé* of work done on growth, and shows that opinions differ as to its cause.

In reply to my criticism of his Paper before the Iron and Steel Institute in 1924, Dr. Andrews suggested that it was no use denying that in the malleablising process the reactions taking place were a direct contradiction to what he (Dr. Andrews) had put forward to explain growth, and he added that the malleablising process and growth were two *fundamentally* different operations.

In my discussion of his Paper before the Iron and Steel Institute the following year (1925) I took exception to this, stating that, like evolution, the process from the precipitation of combined carbon, say, first in white iron, starting with expansion on graphitisation, followed by expansion on growth of graphite, again followed by growth by oxidation, was a continuous process, and it would make it easy to understand if the authors considered the matter from that point of view.

In my opinion it is not possible to form any accurate conception of the primary and secondary causes of growth from work carried out on a laboratory scale, unless this confirms everyday practice.

Dr. Andrews' Paper in 1924 was based upon not only varying analysis but varying fractures, whilst Pearson's results were on grey irons only, but of varying analysis.

It has been said by investigators that white iron will not grow. That, however, is only partially true, for the growth of white iron entirely depends upon the balance of the impurities—outside of carbon—which assist or retard growth, and the temperature to which the specimen may have been subjected.

Further, it would appear that malleablising has a direct application to growth, and Dr. Andrews admits my old contention that the form of graphite flake influences the rate of growth as does also intumescent graphite.

To simplify an understanding of the cause of growth of cast iron it would be well to start with the growth of white iron, for Dr. Andrews agrees with me that the decomposition of combined carbon (which includes cementite and pearlite) is the primary cause of growth. *This is exactly what takes place in the annealing of malleable cast iron.*

The second cause of growth is the size of the graphite flake, *which again has its analogy in annealing malleable cast iron* as seen in the difference of the size of the graphite in blackheart castings and in well-annealed Reumur castings. This second cause of growth is also to be seen in the difference between a close—say, No. 5 pig-iron—and an open No. 1 iron. The character of the graphite flakes in the No. 1 pig-iron causes a permanent "stretch" in the iron, for the graphite continues to contract after the iron has solidified, hence leaving a space which is the cause of the porosity of a No. 1 iron.

The third cause of growth as pointed out in my discussion on Dr. Andrews' Papers is oxidation as illustrated in daily practice in the case of fire-grates and in cast iron, which is subject to high temperatures. This growth by oxidation is seen daily on steel works plant.

The rate of growth, whether in white or grey irons, in the first, second and third stages described above, depends entirely upon the temperature attained and the length of time the iron is held at such temperature, facts which have not always been understood.

It is only in comparatively recent years it has come to be realised that the influence of temperature and time not only play a very prominent part in the whole of ferrous metallurgy from the blast furnace to the finished steel, but plays also a still more prominent part in the non-ferrous world where working temperatures are lower, and much greater care has to be taken in smelting, melting and casting.

Dr. Andrews refers to Eastman's suggestions of possible right and left reactions between Fe, C and O; but whilst this is possible in blast furnace practice, it hardly appears to be so in cast iron, and can safely be dismissed. My conception of the influence of intumescent graphite is not that of lowering the percentage by "oxidising" (burning off), but simply causing an expansion by swelling.—Yours, etc.,

E. ADAMSON.

18, York Street, Sheffield.
June 27, 1927.

Works of Beecroft & Partners, Limited.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In your issue of June 23 "Works Chemist" raises some interesting points regarding the article which has been written on the laboratories and works of Beecroft & Partners, Limited; there are other items which call for elucidation.

For instance, they state "the outlet from the tubes is packed with asbestos wool to eliminate the possibility of CO_2 passing over." Surely this is a very grave mis-statement, as in carbon estimation by combustion the object is to get all the CO_2 over and into the absorption tubes in order to ascertain the amount of carbon present. The writer has always used asbestos wool plugs to prevent scorching of the end stoppers and consequent vitiation of the estimation.

Again, the material quoted as "Carbest" appears to have a variety of uses; boats, bulbs, and even the absorbent for CO_2 are all made from it!

In view of the delicacy and importance of the carbon estimation by combustion, the description of the operation might have been attempted with more accuracy and attention to details.—Yours, etc.,

"ANOTHER WORKS CHEMIST."

Chesterfield, June 25, 1927.

Progress in Iron Founding.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I wish to dissociate myself from much of what is contained in Mr. Adamson's letter published in your last issue. To Herr Sipp and his colleagues belong the credit for placing the hot-mould process on a scientific basis, correlating the mould temperature with the composition and thickness of casting to obtain a true pearlitic structure. The trouble is that no unbiased trial has been made under actual working conditions, so far as I know, to prove definitely what is to be gained. We know at some temperatures higher tests have been obtained from irons cast in dry-sand moulds which receive no reheating. Great influence is being brought to bear by interested parties for the word "Perlit" to be included in certain specifications. If the engineers find it needful to specify, for certain work, the growth after a certain number of alternate heatings and coolings, also certain physical results at a given temperature, that is their province. But leave the method to the manufacturer. That way progress lies.

I have a profound admiration for the way the Germans are tackling the problem of improving cast iron, of which the paper to be given by Prof. Piwowarsky at Sheffield next week is a fair example. While we may not endorse all their claims, their efforts ought to stimulate us to even do better things.—Yours, etc.,

J. SHAW.

Brightside Foundry, Sheffield.
June 25, 1927.

MR. H. E. RICKETTS, who for many years has acted as manager for Thomas E. Gray & Company, Limited, and in other ways has been connected with the foundry supply business, has now joined the firm of H. & E. Crundall, Limited, 52, Coal Exchange, London (and at Dover) in a similar capacity

Institute of British Foundrymen.

ANNUAL CONVENTION AT SHEFFIELD.

List of Subscribers.

The following is a list of subscriptions and promises to the fund which is being raised by the Sheffield Local Committee for the entertainment of the visitors in connection with the annual conference.

Further donations would be welcomed, and remittances should be forwarded immediately to the Honorary Convention Secretary, Mr. W. A. Macdonald, 219, Ringinglow Road, Ecclesall, Sheffield. All remittances will be acknowledged:—The Staveley Coal & Iron Company, Limited, £10; Watsons (Metallurgists), Limited, £2 2s.; the General Refractories Company, Limited, £20; the Consett Iron Company, Limited, £5; Mr. John Shaw, £1 1s.; J. M. Moorwood, Limited, £5 5s.; G. R. Cawood & Company, Limited, £5; W. Jessop & Sons, Limited, £10; the Hopton Mining Company, Limited, £5; the Brightside Foundry & Engineering Company, Limited, £25; Davy Bros., Limited, £10 10s.; William Cook & Son (Sheffield), Limited, £4 4s.; Mr. John T. Goodwin, £10; Thos. Firth & Sons, Limited, £10; Beecroft & Partners, Limited, £5 5s.; T. W. Ward, Limited, £10 10s.; the Berry Hill & Stapleford Sand Company, Limited, £2 2s.; Wm. Cumming & Company, Limited, £20; Mr. H. Winterton, £3; Mr. F. E. McGrah, £2; A. T. Green & Sons, Limited, £1 1s.; W. T. Avery, Limited, £3 3s.; Thos. Clarke & Sons (Sheffield), Limited, £5 5s.; C. & J. Hampton, Limited, £5; C. Butcher & Company, Limited, per Mr. A. Naylor, £5 5s.; Charles Ross, Limited, £5 5s.; Pickford, Holland & Company, Limited, £10 10s.; William Wilde & Sons, Limited, £2 2s.; R. Hyde & Son, Limited, £12 12s.; J. J. Habershon & Sons, Ltd. (Rotherham), £2 2s.; Cox & Danks, Limited, £1 1s.; the Sheffield Testing Works, Limited, £3 3s.; the Hardy Patent Pick Company, Limited, £2 2s.; James Turner & Son, Limited, £2 2s.; J. Durrans & Sons, Limited, £5; Hadfields, Limited, £25; Cammell, Laird & Company, Limited, £10; John Fowler (Don Foundry), Limited, £4 4s.; the Sheepbridge Coal & Iron Company, Limited, £25; Dewhursts Engineering Company, Limited, £5; the Renishaw Coal & Iron Company, Limited, £10; George Oxley & Sons, Limited, £15; Edgar Allen & Company, Limited, £10; Vickers, Limited, £25; Samuel Osborn & Company, Limited, £10; Newton Chambers & Company, Limited, £15; John Brown & Company, Limited, £10. Total, £395 16s.

The Programme.

TUESDAY, JULY 5.—6.0 p.m. General Council Meeting in the Cutlers' Hall, Church Street, Sheffield.

8.0 p.m. A cordial invitation is extended by the Master and Mistress Cutler (Mr. and Mrs. David Flather), to all Members, Delegates and Ladies to a reception at the Cutlers' Hall. Refreshments. Dancing, 9 to 11. (Evening Dress optional.)

WEDNESDAY, JULY 6.—9.30 a.m. Conference commences at the Applied Science Department of the University of Sheffield, St. George's Square. Welcome by the Vice-Chancellor of the University (Sir Henry Hadow, C.B.E., M.A., D.Mus., LL.D., J.P.), the Lord Mayor (Alderman J. G. Graves, J.P.), the Master Cutler, the President of the Sheffield Chamber of Commerce (J. H. Chapman, Esq.). Presentation of the "Oliver Stubbs" Gold Medal.

10.0 a.m. ANNUAL GENERAL MEETING. Open to Members, Associate Members and Associates. Agenda:—1. To read, and if approved, to confirm and sign the minutes of the last Annual General Meeting held in London, June 16, 1926. 2.—Presentation of Report of General Council, June, 1926, to June, 1927. 3.—Presentation of balance sheet and statement of accounts. 4.—Resolution *re* proposed alteration of bye-laws. (Notice has been given and copies of the proposed alterations have been circulated to all members.) 5.—*Election of Officers.*—President, Senior Vice-President, Junior Vice-President, Hon. Treasurer, Members of Council (5 to be elected), Trustees, Auditors. 6.—Any other competent business.

10.45 a.m. Open to all Members and Visitors. President's Address.

PAPER: 1. Presented on behalf of the American Foundrymen's Association:—"The Properties of Coke affecting the Cupola Melting of Steel" ("*Influence des Propriétés du Coke sur la Fusion de l'Acier au Cubilot*"), by J. T. MacKenzie, American Cast-Iron Pipe Company, Birmingham, Alabama, U.S.A.

PAPER: 5. "The Importance of Air Control in Efficient Cupola Practice" ("*Importance du Contrôle du Vent dans la Bonne Conduits du Cubilot*"), by P. H. Wilson, M.I.Mech.E. (Member), Foundry General Manager, Stanton Ironworks Company, Limited. Joint discussion on Papers 1 and 5.

PAPER: 7. "Strains in Non-Ferrous Castings" ("*Les Tensions dans les Moulages en Métaux Non-Ferreux*"), by C. H. Desch, D.Sc., Ph.D., F.R.S. (Member), Professor of Metallurgy in the University of Sheffield. Discussion on Paper 7.

1.0 p.m. Lunch at the University, Western Bank. Tickets, 3s. each (Members, Delegates and Ladies).

2.15 p.m. Motors will leave the University and convey parties of members to one or other of the following works, which members are kindly invited to visit:—Edgar Allen & Company, Limited, Cammell, Laird & Company, Limited, Newton, Chambers & Company, Limited, Vickers, Limited.

7.15 p.m. Banquet at the Royal Victoria Hotel, for Members, Delegates and Ladies (Evening Dress optional). Tickets, 10s. each, Member and Lady, 17s. 6d. Dancing, 10.30 to 12 midnight, providing sufficient applications are received.

ARRANGEMENTS FOR LADIES.—2.0 p.m. The Convention Committee invite all Ladies to join a motor coach excursion to Baslow, to visit Chatsworth House.

Tea will be provided at the Grand Hotel, Baslow. The motor coaches will depart from Sheffield University at 2.0 p.m.

THURSDAY, JULY 7.—9.30 a.m. Conference resumes at the University, St. George's Square.

PAPER: 3. Presented on behalf of the Association Technique de Fonderie de Paris: "Note on the making of Steam Engine Cylinders and Piston Rings" ("*Note sur la Fabrication des Cylindres a Vapeur et des Segments de Piston*"), by Monsieur Audo, Chief of Foundries of the Paris-Orleans Railway Company. Discussion on Paper No. 3.

PAPER: 4. "The Influence of Chromium and Nickel on High Quality and Heat Treated Cast Irons" ("*Influence du Chrome et du Nickel sur les Fontes à Haute Résistance et sur les Fontes Soumises aux Traitements Thermiques*"), ("*Der einfluss von Chromium und Nickel auf hochqualitaet und Waermebehandelte Gusseisen*"), by Professor Dr. Ing. Piwowarsky, of the Technical High School, Aachen, Germany.

PAPER: 8. "The Strength of Cast Iron" ("*La Résistance de la Fonte*"), by J. E. Fletcher, M.I.Mech.E. (Member), Consultant British Cast Iron Research Association. Discussion on Papers 4 and 8.

PAPER: 9. "The Effect of Manganese and Manganese Sulphide in Whiteheart Malleable" ("*Les Effets du Manganese et du Sulfure de Manganese dans la Fonte Malléable à Coeur Blanc*"), by E. R. Taylor, A.R.S.M., F.I.C. Discussion on Paper No. 9.

1.0 p.m. Conference adjourns.

1.15 p.m. Lunch at the University, Western Bank (Members, Delegates and Ladies). Tickets, 3s. each.

2.30 p.m. Conference continues.

PAPER: 2. Paper presented on behalf of the Association Technique de Fonderie de Belgique:—"Some Methods of Making Steel Castings"

(" *Des Méthodes de Fabrication des Pièces d'Acier coulé* "), by Monsieur Georges Fosseprez (Member).

PAPER: 6. " The Manufacture of a Large Steel Casting " (" *La Fabrication d'un Grand Moulage d'Acier* "), by F. A. Melmouth (Member), and T Brown (Associate Member), of Messrs. Thos. Firth & Sons, Limited. Discussion on Papers 2 and 6.

4.0 p.m. Conference adjourns.

4.30 p.m. to 5.30 p.m. Civic Reception at the Town Hall by the Lord Mayor and Lady Mayoress (Alderman and Mrs. J. G. Graves. (Members, Delegates and Ladies.)

8.30 p.m. All Members, Delegates and Ladies are invited by the Convention Committee to attend the performance at the Hippodrome.

ARRANGEMENTS FOR LADIES.—10.30 a.m. Ladies are invited to visit the works of Messrs. Mappin and Webb.

FRIDAY, JULY 8.—9.30 a.m. Parties of Members are invited to visit one or other of the following works:—Brown-Firth Research Laboratories. Darwins, Limited (Safety Razor Blade Manufacturers). Davy Bros., Limited, Samuel Osborn & Company, Limited.

1.0 p.m. Lunch at the Grand Hotel, Sheffield. Tickets, 3s. each (Members, Delegates and Ladies).

2.30 p.m. Motor coaches to Derbyshire Dales (Members, Delegates and Ladies). Tickets, 15s. each, including dinner.

ARRANGEMENTS FOR LADIES.—9.30 a.m. Ladies are invited to take part in one of the following visits:—" Sheffield Telegraph " or Messrs. Darwins, Limited. The party visiting Messrs. Darwins, Limited, will be a joint party of Members, Delegates and Ladies.

Registration.—Members and ladies attending the Convention will receive, per post, prior to reaching Sheffield, a registration card, bearing the member's registration number. This card should be exchanged as soon after arrival as possible at the Convention office for an envelope containing tickets desired for various functions and visits.

Souvenir Booklet.—A Souvenir Booklet, giving programme in detail, will be supplied to each Member and Lady attending the Convention.

Conference Office and Information Bureau.—An office will be open, as shown below, for issue of tickets, booklets, etc., and for general information:—Tuesday, 5 p.m. till 8 p.m., the Cutlers' Hall. Wednesday, 9 a.m. till 12 noon, the University. Thursday, 9 a.m. till 10 a.m., St. George's Square.

Correspondence.—Members may, if they wish, during the period of the Convention, have their correspondence addressed—c/o the Hon. Convention Secretary, as follows:—c/o Mr. W. A. Macdonald, Applied Science Department, University of Sheffield. Telegrams: " Conference, Applied Science, 42071." Telephone: 42071. Correspondence so addressed will be available at the Conference Office.

Railway Facilities.—The railway companies (except the Metropolitan and London Electric Railways) have agreed to issue tickets at the ordinary fare and one-third for the double journey, fractions of 3d. reckoned as 3d., upon surrender, at the time of booking, of vouchers obtainable from the general secretary. The tickets will be available from July 4 to 9.

Personal Paragraphs.

MR. W. C. MITCHELL has been appointed manager of the National Oil Refineries, Limited, Llandarcy. Mr. Mitchell took his engineering course at the Imperial College of Science and Technology, London University, and later became resident engineer on construction with Mott and Hay, consulting engineers on railway bridge, harbour and tube construction. Afterwards he became engineer and sub-agent with Sir John Jackson, Limited, public works constructors. Mr. Mitchell joined the staff of the Anglo-Persian Oil Company in 1923, and has been successively assistant chief engineer of the company, manager of its engineering department, and chief engineer of the production department.

Wills.

MACKENZIE, SIR WILLIAM, of Toronto, a director of the Dominion Steel Corporation, Limited, and of the Dominion Iron and Steel Company, Limited £17,249

Iron and Steel Institute.

Autumn Meeting at Glasgow.

As previously announced, the autumn meeting of the Iron and Steel Institute will be held at Glasgow on Tuesday, Wednesday, Thursday and Friday, September 20 to 23. The following is an outline of the arrangements:—

Monday, September 19.

The Secretaries' office will be open from 3 to 6 p.m., at the Royal Technical College, George Street, Glasgow, for registration of members and distribution of programmes, badges, etc.

Tuesday, September 20.

The Secretaries' office will open at 9 a.m. At 10 a.m. the President of the West of Scotland Iron and Steel Institute, the Rt. Hon. Lord Provost of the City, and the President of the Chamber of Commerce, will welcome the Institute in the Examination Hall of the Royal Technical College (Montrose Street entrance). A general meeting of members will follow in the Societies' Room, for reading and discussing papers.

At 1 p.m. a luncheon will be given to members and ladies by the Reception Committee at the Central Hotel. After luncheon motors will be in readiness to convey parties of members to visit works.

On Tuesday evening there will be a reception and dance in the City Chambers, by invitation of the Rt. Hon. Lord Provost and the Corporation of the City of Glasgow.

Wednesday, September 21.

At 10 a.m., general meeting of members at the Royal Technical College, for reading and discussing papers. At 1 p.m., luncheon for members only, given by the President and Directors of the Glasgow Chamber of Commerce. After luncheon motors will be in readiness to convey parties of members to visit works.

Arrangements will be made for members and ladies to dine together on Wednesday evening at the Central Hotel. The inclusive charge for tickets for this function will be 12s. 6d. each.

Thursday, September 22.

At 10 a.m., general meeting of members at the Royal Technical College for reading and discussing papers. At 1 p.m., luncheon for members and ladies, by the President of the West of Scotland Iron and Steel Institute and the Reception Committee, at the Central Hotel. After luncheon motors will be in readiness to convey parties of members to visit works.

Friday, September 23.

Arrangements have been made by the Reception Committee for an all-day excursion on the Firth of Clyde in SS. " King George V." The charge for tickets, including lunch and afternoon tea on board, will be 10s. 6d. per person.

General Information.

The Central Hotel, Glasgow, will be the headquarters of the Institute. For all members taking part in visits and functions during the meeting there will be a fee of £1, and for each lady a fee of 16s., as a contribution to the expenses of the Reception Committee. This charge is additional to those for the dinner on Wednesday night, a supper dance on Thursday night, and the excursion on the Clyde on Friday.

In the case of visits to works the invitations of the various Companies are limited to 50 visitors, and it is not possible to include ladies in the invitation.

THE DIRECTORS OF THE Butterley Company, Limited, recommended that the capital of the company be increased from £1,200,000 to £2,000,000, and that £600,000 of the general reserve be capitalised and distributed among the members as fully paid up £1 shares in the proportion of one share for every two now held.

IN CONNECTION WITH THE centenary celebrations of University College, Dr. J. A. Fleming, Emeritus Professor of Electrical Engineering in the University of London, delivered at the college recently, a lecture on " A Hundred Years of Electrical Engineering." Mr. Roger T. Smith, past president of the Institution of Electrical Engineers, presided.

Loam Moulding.

By J. E. P.

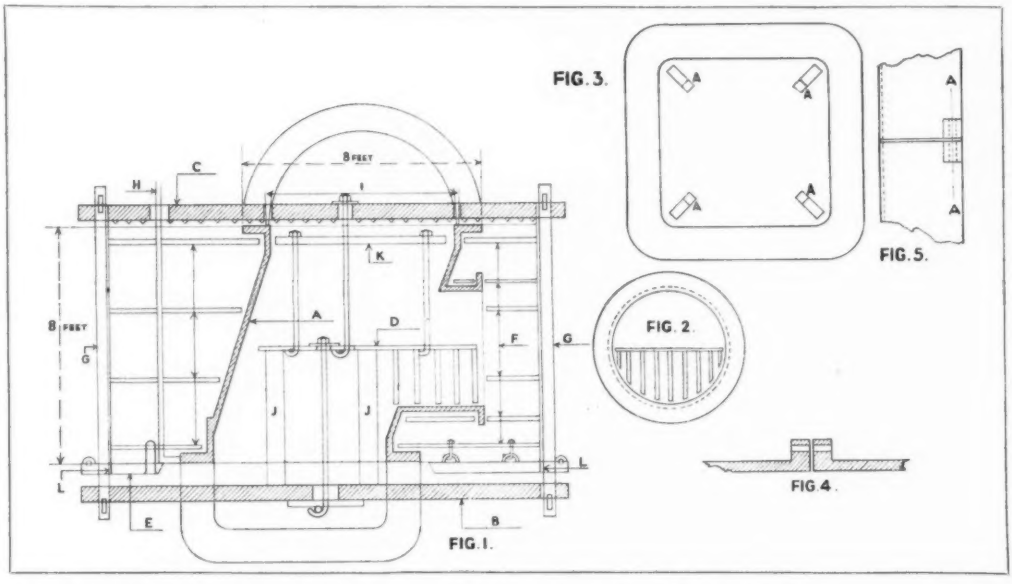
Loam moulding is being superseded by dry-sand moulding to a very large extent, chiefly on account of the expense of the former and because there are so few reliable loam moulders. Yet there is a certain class of castings which will always have to be made in loam; on the other hand, no doubt, there have been many castings made in loam which could more profitably have been made in dry sand. Some loam jobs have come under the author's observation which, if made in dry sand, could have been made in one-third the time taken to make them in loam, and a far better casting would have been obtained, but the management were afraid to lay out a few pounds in the necessary tackle. In undertaking any piece of work, care and study must be given to it before it is started, and the practical foundryman must be consulted as to the way the pattern—if any—should be made.

Loam moulding differs in many respects from sand moulding, and not much information reaches us through the media of technical papers or text-books, which, after all, give a very vague idea of actual *modus operandi* of the art. The apprentice who contemplates taking up the art of loam moulding as a means of livelihood finds later that reading is of very little use to him. It is difficult for a practical man to give a clear description of loam moulding; still much more difficult for the theoretical man to attempt to do so. The only way to acquire the knowledge is by actually working in the foundry, and retaining the knowledge so acquired by constant practice.

Perhaps it is quite impossible to deal adequately with this subject in any Paper, but articles should appear from time to time giving the best possible advice upon the matter, and such advice is most serviceable if it is given from actual practical experience. Such advice should be most valuable to the student and the young man in the foundry who is not given the opportunity to progress. A case in point came to the author's notice recently in a foundry undertaking loam work. There were some very good loam moulders and one lad. All the loam moulders at a certain time had better jobs offered them, which in due course they accepted, leaving only the lad to finish the work in hand, which was a job which had to be made in loam, and weighed about six tons. The foreman was very worried as to how to get this job through in the time allotted for it. There are, of course, some sand moulders who can undertake and execute satisfactory loam jobs, but it is a very risky proceeding to give a loam job to an ordinary sand moulder. So after very careful thought the foreman decided to trust the job to this lad. Two loam-moulders' labourers were placed at his disposal, and he proceeded in quite a workmanlike manner from start to finish, and made an excellent job of it, whilst the buyer said it was better than they had ever had before. Lads should be given greater scope than they are given.

The sketch A (Fig. 1) shows a piece of work not very difficult nor intricate, yet every operation had to be visualised before the foundation plate was made or a brick laid. As soon as the drawing came into the works a copy was given to the foundry manager, who was not expected to decide the price, but the method of moulding the time of delivery being *at once*. He was, however, given several days to think it over. He then took the loam moulder into consultation, and together they saw the job right through. In making the foundation plate B all the necessary provision was made, not only for lifting the plate with the centre or core built upon it for drying in the stove, but for lifting the complete mould for lowering into the casting pit, and also for securing all parts to it to resist the strain which would be placed upon the mould at the time of pouring.

When the foundation plate B was placed upon the loam floor—which is usually of cast-iron plates



—it was levelled and bricking commenced. About four courses of bricks up to the first joint were laid and the joint struck. After this had stiffened, the skeleton pattern was then placed upon it, and the foot plates E were offered up to fit nicely. Very strong staples were cast in the foot plates for bolting all the middle binders F securely. Then more bricking until the place for the first binder F was reached. The binder was placed up and bolted down, and so on, with all binders F. A row of loam bricks was placed behind the flange to allow for contraction. The overhanging branch pipe core was supported by a specially-made grid D, packed and bolted upon bearings J. Section of the grid is shown in Fig. 2. To this grid the top ring K was bolted, so making the centre or core perfectly rigid, provision, of course, being made for the free escape of all gases. The middle part of the mould was made in halves, making the joint vertically down the branch pipe flange, so that each half of the mould would draw away from the skeleton pattern. Each half, as will be seen, had to be lifted away, therefore it had to be so built so as to withstand the movement of lifting by the travelling crane. In one half a down runner H was placed, so as to admit a certain amount of metal at the bottom; other runners were placed at the top I. The top plate C was quite as strong as the foundation or bottom plate, not so much for lifting, but for reasons of bolting down and holding the sides of the middle part of the mould from bursting away at the time of pouring. For this reason twelve strong cast-iron bars were

made, as shown at G; these bars were placed through the holes in the top plate, foot plate, and foundation plate; then the middle part was wedged as at L. Also these bars had slot holes cast in at each end, so that they answered as bolts as well, by wedges being driven into the slots under the foundation plate and above the top plate. Fig. 3 shows the bottom flange in the corners at A. Cast-iron plates were built up in the centre or core. These plates were the total length of the casting, and slightly tapered, about 1½ in. thick at the bottom and 2 in. at the top, and wide enough to reach the whole thickness of brickwork. One might say that these contraction bars or plates almost divided the core into four sections. Of course, they were built up in such a way that the core would not collapse. The great advantage of these is that as soon as the mould was poured and the metal set the top plate was lifted off and these contraction plates drawn out of the core, thus leaving the core quite free to crush in when the contraction of the casting commenced. This is by far a better way than cutting four rows of brickwork out of the whole length of the core, which would occupy six or eight men four hours or more.

Under the top flange the loam bricks were eased, as also was the runner H. After a time all bolts on the outside were released; this allowed free play for the contraction. Figs. 4 and 5 show the ends of the foot plates E. The lugs cast on the top side of the plates assisted very materially in holding these firm and prevented the slightest movement. All the binders were also packed and wedged to the stay bars G. It was fully realised that the great pressure put upon the mould at the time of pouring had to be guarded against. It was very gratifying to know that this casting was very satisfactory in all respects; very little fettling was required, and it machined up quite nicely.

The French Ironmasters' Association.

Report for 1926.

The Comité des Forges de France has just issued its annual report dealing with the activity of the industry in France and other countries last year, from which we cull the following extracts:—

The French production of pig-iron increased from 767,000 tons in January, 1926, to 830,000 tons in December, with 156 furnaces in blast at the end as compared with 147 at the beginning of the year, and the output of steel from 666,000 tons to 741,000 tons in the same two months respectively. For the whole of the year the output of pig-iron amounted to 9,431,000 tons, or an increase of 11.4 per cent. on 1925 and one of 3.9 per cent. on that in 1913 within the present territorial limits of France. In the case of steel ingots and castings the year's production reached 8,430,000 tons, or an increase of 13.2 per cent., as compared with 1925, and one of 20.8 per cent. over that in 1913 within the present frontiers.

The industry had to face at the opening of 1927 a general abstention of inland customers. The necessity of keeping the iron and steel works in normal working so as not to burden the costs of production with expenses which grow so rapidly when the production diminishes, and in order to prevent unemployment, led in many instances to sales without any profits and often at a loss.

The report next proceeds to discuss the fuel question. The coke consumed by the iron and steel industry is obtained from three principal sources: the French collieries, the cokeries which the ironmasters have established either at their own works or at coal pits in France and abroad, and the deliveries from Germany.

The remarkable efforts by the inland collieries has brought the production of coal up to 51,408,000 tons, or 17.5 per cent. over that in 1913, within the present frontiers, and that of metallurgical coke to 3,767,000 tons, being 25 per cent. in excess of that in 1913 and representing a monthly average of 314,000 tons. But the price of coke is still unduly high, as it is seven times the pre-war rate, while the price of steel is at the same time scarcely four times the pre-war rate. It is to be hoped that the discussions now proceeding with the coalowners will permit of the re-establishment of the relations which existed between the two industries in pre-war days and bring about harmony between the cost of coke and steel prices. This co-operation is all the more imperative as the country is able to produce more than twice its own consumption of the metal and has become the largest exporter of steel; and as the country is still dependent for a part of its coke supplies upon the German pits, which are in the hands of competitors in the world's steel markets.

A great effort has also been made by the ironworks' own cokeries and although the British strike inconvenienced a certain number of them in respect of both the tonnage and the price of coking smalls needed by them, it is now possible to rely on the certainty that despite the increase in the home production of pig-iron, the French works will become less and less dependent upon the foreigner for their coke supplies.

The deliveries of coal and coke from Westphalia followed a regular course, except when they were interfered with by navigation difficulties on the Rhine.

The production of iron ore followed normally the working of the blast furnaces and exceeded 39,000,000 tons. At certain times the production was handicapped by the scarcity of foreign labour.

Dealing with the question of scrap, the report states that this material is an important factor in the costs of production, seeing that the scrap consumption of the blast furnaces and steel works in 1926 amounted to over 3,000,000 tons. Some districts more particularly interested through the nature of their manufactures, as for instance the Nord and the Centre, were placed in a difficult position towards the end of the year in the matter of supplies of scrap, and if the general crisis which slackened the activity of these works had not intervened, this situation might have become critical. Far from being abundant the scrap resources of the country are only sufficient to meet requirements, and if as a result of particular circumstances certain works were induced to intensify their production, they would experience serious difficulties. This is a situation to which the Comité has not ceased drawing the attention of the Government, especially of the departments of War and the Navy. As an essential measure of security it is considered that the embargo on scrap exports, that was imposed by the decree of December 29, 1922, should be fully maintained.

The report next proceeds to deal with wages and labour conditions and with taxes and costs of transport, and then approaches the question of the organisation of the industry. The ironmasters, it is stated, were specially occupied last year with a general organisation of the industry, rendered necessary by the development of the means of production both in France and other countries. The producers of phosphoric pig-iron on the one hand and those of hematite iron on the other formed a group which, without being a selling organisation, as was the case with the former Metallurgical Comptoir of Longwy, permits of the adjustment of the production to the needs of the market through its constant relations with consumers, and of giving the latter the necessary assurances in the matter of their supplies. A Rail Comptoir also maintains a continued contact with the large railways which permits of the works proceeding with more regularity with the execution of orders for permanent-way material.

Concerning international understandings, the report recalls the fact that the Continental Steel Trust does not affect the question of markets, and that therefore the French industry may claim in all markets the legitimate share which is its due from the fact of its importance and the value of its manufactures. But the industry is subject to free competition and it is necessary for it to struggle keenly in order to carry out the tonnage programme assigned to it. All efforts have been made to develop the selling organisations established abroad. At the same time it is considered particularly interesting for the exports to proceed in the form of products converted into manufactures. Henceforth, this great industry will be able to calculate at nearly 5,000,000 tons the total quantity of its exports, and it is suggested that this effort should be continued.

Foundry Purchasing.—IX.

By Eric N. Simons.

Whatever the size of a foundry purchasing department, certain activities have to be carried on by its staff. If the extent of the purchases made during the course of a year is large enough, a separate functionary for each activity may have to be provided. If the amount of purchasing done in a year is but small, several of these activities may have to be grouped together and performed by one person alone. In very small foundries, the buyer himself constitutes the buying office, and carries out everything. The size of the department cannot, therefore, be decided by any fixed rule.

More important than idle speculations as to the right size for a buying office—speculations that cannot have a final answer—is a close examination of the activities carried on. In Fig. 1 in the previous article is given in diagrammatic form a skeleton plan of an efficient foundry buying office. The relation of the department as a whole with other sections of the firm, however, needs treatment. It will be seen that there is a link on the plan between the buyer and the laboratory. This is essential. As an example, coal may be taken. This, if supplies are obtained from or offered by a new source, needs to be tested for calorific value, ash content, and—when necessary—for gas production. Petrol, to give another instance, needs to be tested for specific gravity. Lubricating oil has to be tried out in the laboratory for viscosity, flash-point and so forth. In addition, refractory materials, pig-iron, scrap, alloys, foundry sands, and practically every other kind of production materials, have to be tested in one way or another. It is the department's task to see that the laboratory thoroughly examines, tests, and reports upon the various samples and new supplies.

Another link is shown between the buying office and the traffic department (assuming that such a department exists, as it does in all well-organised foundries; and even if it does not, the necessity for the work detailed under this heading remains). By co-operation with this department, the buying office can sometimes obtain lower carriage rates, as previously described. The necessity for close contact with the stores, the works, the Board of Management, the accounting and other offices, and the various exchanges and markets, has previously been indicated. Thus, the external relations of the department have been specified, and the need for them clearly outlined. One may now turn to the internal structure.

Staffing the Buying Office.

Under-staffing or over-staffing are possibilities not to be ignored. They exist, and if allowed to become realities, may very seriously affect the efficiency of the whole department.

In a buying department of any size there will be a need for at least four assistants, apart from the buyer, the typists, and the correspondence staff (if any). These four assistants will each cover one section of purchasing activity. There are four characteristic kinds of purchases:—(1) Purchases of raw materials; (2) purchases of works materials and maintenance supplies; (3) purchases of materials for resale; and (4) purchases of stationery and office supplies.

These four kinds will be found to exist side by side in practically every purchasing department. They cover almost entirely separate divisions, and can, therefore, be safely isolated, in so far as apportioning each to a separate assistant is concerned.

Raw materials are principally those required for production purposes, and their purchase will, therefore, affect the various works departments. Works materials and maintenance supplies comprise (a) materials for works use, such as are stocked by the stores department; (b) supplies for the building and maintenance departments. Purchase of these will principally affect the works departments and the works engineering department.

Materials for re-sale may be of two kinds: (a) those forming an accessory of the castings; (b) those obtained solely to re-sell or "merchant" to customers. Purchase of these will principally affect the sales manager and the heads of the foreign and overseas exporting departments.

Stationery and office supplies and furniture form a category that needs no elaboration. Purchase of these chiefly affects the various heads of office departments.

There is a fifth category, namely the purchasing of printing and other publicity supplies; but this is not a legitimate part of the buying department's work, and will not, therefore, be discussed here.

Under the supervision of the buyer, each of these four assistants should be responsible for the detail work in connection with his own class of purchases. This detail work is divisible into a number of sub-sections, as follows:—(a) Recording of statistics; (b) detail work of buying; (c) obtaining of delivery; (d) checking of deliveries; (e) passing of accounts; and (f) storage or delivery to consumer.

To show the exact functions to be performed, it will be necessary to take each of these six sub-sections in turn, and analyse it a little more closely.

(a) Recording of statistics comprises the noting down of all relevant data in regard to sources of supply, and the keeping of these notes up-to-date; the statistical tabulation of past purchases, current prices, single offers or quotations, and so forth; the noting down of laboratory and other test reports; the establishment and maintenance of maximum and minimum quantities; an assessment from time to time of future requirements.

(b) Detail work of buying covers such work as examining and classifying requisitions in readiness for ordering bulk quantities; obtaining prices for bulk or single lots of goods or materials; making out orders and checking them over with requisitions; forwarding orders and keeping copies, carrying on of correspondence necessitated by orders; and keeping track of deliveries, *i.e.*, noting quantities delivered, etc.

(c) Obtaining of delivery is important. It involves regularly and systematically reminding suppliers of their delivery promises; seeing that penalty clauses are enforced where necessary; visiting suppliers' works to explain the importance of promptness and despatch in execution; ensuring that any material or pattern that has to be supplied by the ordering firm before the goods can be completed by the supplier is sent off in good time; facilitation of traffic arrangements in co-operation with the traffic department, or, if no such department exists, actually making the necessary representations to the railway companies; securing of prompt payment of suppliers' accounts, if goods on order are delayed in delivery through negligence in this respect on the accountant's part; and in short, removing every obstacle to rapid and safe delivery.

(d) Checking of deliveries carries with it the necessity to visit the supplier's works in order to test, inspect, and pass, material, where needful, before despatch; the necessity to inspect, analyse, test, the goods on their arrival, or ensure the performance of these operations by the competent persons; and the obtaining of competent reports on the goods and their performance by those who have to use them.

(e) Passing of accounts comprises the checking over of the items invoiced with the deliveries actually received, to ensure that more are not charged for than have been sent; the checking over of the invoiced quantities with those actually ordered, to ensure that the amount specified has not been deliberately exceeded; the comparison of prices charged with those specified on the order or named in a quotation; the classification of the various accounts, to enable the accounts department to make the proper allocating entries in their ledgers, thereby ensuring that each branch or department of the business is charged with the goods ordered on its behalf; and finally, the marking of the invoices with symbols and initials to indicate to the accountant that they may safely be paid.

(f) Storage or delivery to consumer covers the detailed work of receiving the goods, notification to the consuming department or storekeeper of their arrival, storage in fit and commodious premises on a systematic basis; issuing for use as required; maintenance of accurate stores records and departmental charges for goods supplied from store.

Electric Power in the Foundry.

BY "KILOWATT."

Among the many applications of electricity for power purposes in the engineering and allied industries none perhaps offers greater scope than those in the foundry. Although considerable progress has been made in the last two or three years in regard to the installation of electrical equipment in foundries, both ferrous and non-ferrous, it cannot be said that it has been carried out on anything like a general scale. It may be that the intermittent and peak character of the foundry power demand has proved a deterrent. Cranes, runways, moulding machines, air compressors, and blowers, are naturally spasmodic in use and are only required to operate periodically. This means that while the aggregate horse power of motors installed may be high, the actual power used is relatively small in proportion. Moreover, it may be argued that the conditions obtaining in a foundry are anything but suitable for electrical apparatus.

Nevertheless, in spite of these seeming disadvantages, electricity in the foundry, both in the form of heat and power, is making rapid strides, and it can only be a matter of time before foundry electrification in this country will be as complete as it is to-day in America and Germany. The electric motor has now become recognised as a thoroughly reliable and efficient form of prime mover, and its construction is such that it will work satisfactorily under the most adverse conditions, but the real argument for the electric motor in the foundry lies not so much in merely supplying power as in its ability to perform flexibly and automatically the various operations essential to high speed production. It is the blending of such qualities as responsiveness, convenience, greater production and better work that sums up the case for the use of the electric motor.

The success or otherwise of an electrical installation is largely governed by the amount of care and consideration given to the question of purchase and selection of electrical equipment. The subject is one on which a handbook could well be written, but for the purpose of these articles it is proposed to give a brief outline of the essential points to be borne in mind when purchasing electric motors for use in the foundry. The practice of the buyer to pin his faith to one firm whose name may be known to him has its objections, inasmuch as it has the tendency to stifle competition and limits the choice available. He, therefore, should not restrict his inquiries, but obtain quotations from all the reliable makers, and providing he stipulates compliance with B.E.S.A. Specifications he will have at his service the research and experience of a representative number of electrical manufacturers. A guarantee that an electric motor complies with the applicable specification (No. 168 of 1926) of the B.E.S.A. is the best possible safeguard.

The next important step to bear in mind when purchasing an electric motor is its speed in relation to its price. Generally speaking, a motor running at, say, 1,500 r.p.m. will be approximately half the price of a motor running at 750 r.p.m., and the 1,500 r.p.m. machine considerably smaller, although the horse power and temperature rise may be the same. In order, therefore, to obtain a low first cost, the higher speed motor is usually offered, unless a lower speed is specified. If a high-speed motor is installed on account of lower initial cost it may be necessary to employ some form of speed-reducing gear, but it should be borne in mind that the efficiency of a high-speed motor is higher than that of the slow-speed motor.

The question of bearings is also of considerable importance. When inviting quotations it is wise to specify the type of bearing required. These bearings should be ball or roller or a combination of both. The efficiency and reliability of such bearings are unquestionable, and nearly all modern manufacturers producing a machine of good quality are using them.

A further consideration in the purchase of motors is the type of protection required, and the foundry owner must first of all decide what type of machine he requires, whether it be protected type, ventilated enclosed type, pipe ventilated, totally enclosed, and so on, and ensure that the comparison of quotations is equal on this basis.

Briefly, the recognised definitions of the types of electric motors available for industrial purposes are as follows:—

(*a*) *Open End Bracket Machine.*—This machine has end bracket bearings forming an integral part of the machine yoke. It has the advantage of good ventilation, but the restriction that it can only be used in a machinery room.

(*b*) *Protected Machine.*—One in which the internal rotating and live parts are protected mechanically from accidental or careless contact. A machine of this type is suitable under certain conditions.

(*c*) *Enclosed Ventilated Machine.*—One in which the ventilated openings in the frame are protected with an expanded metal screen, the apertures in which, in compliance with the rules, do not exceed ½ sq. in. in area. It is easily ventilated, usually being cooled by an internal fan and is readily accessible for cleaning and inspection.

(*d*) *Totally Enclosed Machine.*—Enclosed as to prevent circulation of air between the inside and outside of the case, but not necessarily airtight. It is suitable for positions where there is damp, or dust of not too fine a nature. As the machine is totally enclosed and therefore gains no direct ventilation to its windings from the outside air, its heat has to be dissipated by radiation through the case. A slightly increased temperature rise is therefore allowed for this type of machine. The cost of a totally enclosed machine is approximately 75 per cent. more than that of an enclosed ventilated machine of the same horse power output.

(*e*) *Pipe Ventilated Machine.*—This type of motor is so arranged that the ventilating air may be conveyed to or from the machine through pipes attached to the frame. The open end of the pipes are generally conducted to clean dry air. There is quite a wide field of use for this particular type of motor, and in actual cost is very little more that that of the ventilated enclosed pattern.

(*f*) *Drip Proof Machine.*—This has a frame provided with openings for ventilation, but so protected as to exclude falling water or dirt. Suitable for use in very damp situations.

The type of starting gear should be perfectly clear in the mind of the buyer and in the quotation of the manufacturer. There are many types, each of them suitable for some purposes, but not suitable for all. Often in a quotation for an electric motor a starter of the cheapest possible type is included, and is described in perhaps two or three words. It is not until the motor gets into daily use that one is able to decide on the suitability of the starter. Starters for electric motors are made of the finest possible types and qualities, but unfortunately little is realised of the importance of this portion of an electric drive.

With these opening remarks on the purchase of motors we will in another article consider the most suitable type for foundry work.

Foundry Trades Equipment and Supplies Association.

At a meeting of the Foundry Trades Equipment and Supplies Association, held last Thursday, Mr. V. C. Faulkner was re-elected president and chairman of Council. Messrs. H. Winterton (Wm. Cumming & Company, Limited) and A. S. Beech (Universal System of Machine Moulding and Machinery Company, Limited) were re-elected vice-presidents, whilst Mr. D. H. Wood (Constructional Engineering Company, Limited) was added to the list of vice-presidents. Arrangements are well advanced for the staging of an International Foundry Trades Exhibition, to be held in June, 1929, at the Agricultural Hall, London, N.

Chromite in Russia.—Recent search along the railway to Orsk in the Southern Ural has led to the discovery at Khalilovo and elsewhere of hitherto unknown deposits of chromite. The ore found near the village Baikasse was reported to carry 43.91 per cent. of Cr_2O_3, and that found near Gainullina 39.06 per cent.

Synthetic Moulding Sands in the Malleable Foundry.*

BY F. C. SCHEIBER, ERIE, PA.

During the past five years more research work has been done towards improving moulding sand for the foundry than in all of its whole past history. The foundrymen are realising that most of their difficulties and problems are in the make up and structure of nature's sands, and are not wholly due to oxides in the molten metal caused by poor quality of pig-iron and rusty scrap.

Moulding sand has been a bugbear for the foundrymen ever since the first casting was cast in sand. Sand wastes were enormous in order to keep their sand piles, as they believed, in first-class condition. We think the moulders of the past generation did very well. But then, again, they had plenty of time to take care of their sand, which was a large part of their job. Production was slow, sand was cheap and they had plenty of time for preparing it. But, as years advanced, times changed, production increased, good uniform sand was impossible to get. The moulder now had little time for pondering over sand conditioning, with the result that this conditioning has been given over to foundry labourers.

The old moulders died off, with them went the reliably kept sand pile and for years the foundry has depended on inexperienced labour to make and blend its raw moulding sand into a workable heap for the foundry. That this has been a complete failure some foundrymen will not admit, but it is nevertheless the case. Thousands of pounds have been thrown on the scrap heap on account of poor moulding sand. Good and intelligent moulders and apprentices have been driven from the foundries on account of having to stand the losses of castings due to sand conditions. New surface sands full of organic matter cannot be transferred from the sand bank and dumped on the moulding floor with expectations of making good castings.

Sands Should be Treated Before Using.

After years of experimentation and of many failures, the writer has come to the conclusion that all moulding sand should be treated before being used. Moulding sand in its natural state is saturated with foreign matter and flame-producing elements, which if not removed before moulding will cause blows, washes, cracks, rough spots, cuts, scabs, blisters, excess shrinkage and prevent the free escape of gases.

The greatest waste in a foundry is discarded sand, which after once being used is thrown out on the dump at a cost of 8s. per ton to carry it out of the foundry. Along with it goes iron scrap of good value. If one can only reclaim the value of this material which is now classed as refuse, by running it through a reviving system, it provides a base sand free of all foreign matter which will produce, if treated rightly, a better sand for all classes of moulding than when it was in the green state. Some foundries make a practice of putting this sand back in the sand heap without cleaning. This should not be done as the silt in it causes the sand pile to decrease in permeability, which lack of permeability in the sand causes an increase in defective castings.

Old Core Sand Makes Excellent Base for Moulding Sand.

Take the burnt-out moulding sand which clings to the hot castings on the shake out and the used core butts and old cores which are hooked out of the sand after pouring and run this material through a cleaning process. Can you get any better sand as a base than old core sand with its perfect round grains which prevent interlocking when rammed in the mould, thereby guaranteeing a free vent for the escape of gases?

Is there a cleaner sand to be found for moulding purposes than this sand high in silica content? Yet, this sand was formerly thrown on the dump. One can use this valuable sand after cleaning by blending it with discarded moulding sand and make any kind of a new moulding sand required for medium, light or heavy work. And it will be a dependable sand. It also will be one which will cut foundry defectives to a minimum.

For the past two and a half years the author has been using nothing but prepared sand in his malleable foundry at Erie, Pa., and the results have proved very satisfactory. Losses have decreased beyond expectation. The moulders are highly pleased with the conditions. The appearance and surface of the castings have improved and moulding conditions in general are greatly improved.

Treating Core Sands for Moulding Purposes.

Treating core sands for moulding purposes is a simple one provided the sands are put into shape for such treatment. For instance, the sands used should be of uniform size, round and of good sound structure, such as Ottawa or Michigan drift sands. The sand can be used first for cores, and, after casting, all core butts, scrap cores, core room sweepings and discarded sands should be run through a barrel-type furnace with heat high enough to burn out all core binder and water crystals on the surface of each grain in order to make the surface clean and rough to hold the clay bath. The heat should be high enough to break down all cores without a grinding operation, as grinding destroys the round sand grains and makes sharp grains which are a detriment to a good moulding sand.

All sands should be screened in the dry state and scrap removed, and all excess dust and silt should be eliminated by air separation before mixing. By doing this one removes 90 per cent. of the moulding-sand troubles.

A mixing machine of a large enough capacity should be used for mixing the moulding sand to give it the required blending, or, in other words, distribute the clay evenly around each grain of sand without breaking up the sand-grain structures. This operation is important to get good results, for where one substitutes a grinder or any other kind of method to do this work it will prove a failure.

Selection of Proper Clay Important.

The proper clay to use for the bonding purposes in moulding sands is a problem and should be given much thought and study; for on the clay used, hinges the success of this process. First, one should use a clay with high resisting qualities and containing over 60 per cent. of colloids. For good moulding sands depend not only upon the colloidal content in the clay, but to the extent to which this content is held under various conditions of heat.

The clays used should be pulverised to a fineness of 40-mesh or better, and made into an emulsion bath and have this bath worked in such a manner that the disruption and dispersion are so complete that all are changed into a colloidal mist.

Dry clay should never be added to the sand heap, for it is impossible to distribute it evenly over the pile and coat each grain of sand with the desired amount of clay without forming clay balls and clay pockets which are detrimental to good foundry practice.

Use of Glycerine Prevents Drying Out too Quickly.

For a long time, the writer has had difficulty with the sand drying out too quickly both in the pile and in the moulds. This was found to be true in large moulds where the drag and cope were exposed a long time before closing, and the moulder had trouble in slicking and patching on account of this dryness. This difficulty was corrected by the use of a small amount of glycerine in the emulsion bath. This is something new in the foundry industry and will keep the sand moist for hours or days according to the amount of glycerine used.

Care in Mixing Process Needed.

Great care should be used in the mixing process. The material should only be milled long enough for complete distribution. To the treated sand is added enough coal dust to produce a mild smudge when coming in contact with the molten iron. This insures a smooth casting easily cleaned. A small part of cornflour for green bond should then be placed in the mill and milled

* A Paper read before the Chicago Meeting of the American Foundrymen's Association. The author is Superintendent, Malleable and Alloy Foundries, General Electric Co., Erie, Pa.

for two minutes, to this mixture then the clay-glycerine emulsion bath is added and again milled for three minutes. This newly-prepared sand should then be riddled to give it a light, fluffy and well-aerated product before beginning the moulding operations, and this sand should be used in making the entire mould.

Satisfactory Results Shown.

Moulding sand prepared in this manner is a free-venting sand with sufficient outlet for the steam and air generated by the molten iron entering the mould, which guarantees a good sound casting.

It is a great mistake for foundries to use a good facing sand of a fraction of an inch in depth next to the pattern and back this up with old heap sand full of silt and expect a good casting.

A good grade of moulding sand made as described can be used for all classes of work and will produce good sound castings with a better surface than a mixture of several grades of natural sand. The reason for this is that the sand grains are all uniform and can be rammed to the surface of the pattern which produces a smooth surface and clean pattern draw. This method will fit in very nicely where foundries have sand conveying systems.

The time is at hand for the foundries to install their own sand-handling and sand-treating machinery to insure a good reliable product—a product which will produce good castings free of blemishes, which in turn automatically increases production and makes use of good materials formerly thrown on the dump. All of this means a great saving in money and many worries for the foundry superintendent.

The Influence of the Working of the Blast Furnace on the Total Carbon Content of Pig-iron.

A. Michel* made investigations with six blast furnaces in order to examine what factors might control the total carbon content of the pig-iron. As the experiments show, the carburising process is not yet finished in the shaft and the boshes of the furnace. Iron drops which were caught by means of an angle iron driven into the furnace through the tuyères showed a total carbon

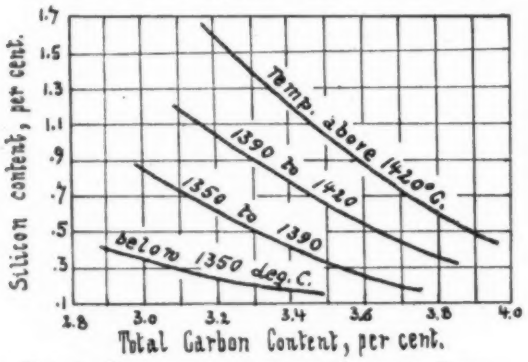


FIG. 1.—RELATIONSHIP BETWEEN CHEMICAL COMPOSITION AND TEMPERATURE OF BASIC.

content of 0.1 to 3.0 per cent. Therefore it must be concluded that the definite composition of the pig-iron is not reached but in the hearth of the furnace. In order to examine the influence of the temperature on the total carbon content temperature measurements were taken from the tapped iron. The results are plotted in the figures 1 to 3. Fig. 1 gives the relationship between the chemical composition (total carbon and silicon) and the temperature of basic pig-iron; Fig. 2 that of hematite; and Fig. 3 that of foundry pig-iron. The curves show that apart from the silicon content the carbon content depends from the temperature, and therefore it may be concluded that the temperature in the hearth of the furnace is the main factor which controls the carbon content of the pig-iron. All those factors which influence the temperature in

* Stahl und Eisen, No. 17, pp. 696/8.

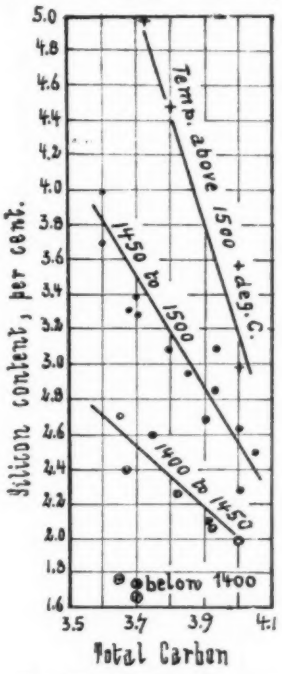


FIG. 2.—RELATIONSHIP BETWEEN CHEMICAL COMPOSITION AND TEMPERATURE OF HEMATITE.

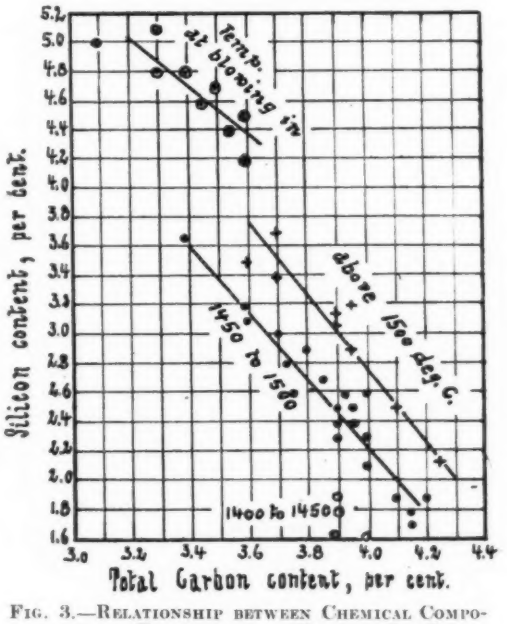


FIG. 3.—RELATIONSHIP BETWEEN CHEMICAL COMPOSITION AND TEMPERATURE OF FOUNDRY PIG-IRON.

the hearth, such as direct reduction, period of working charge, or temperature of the blast, will indirectly influence the total carbon content.

Selling Fluorspar on Analysis Basis.—In American practice fluorspar is now bought by the makers of basic open-hearth steel for its content of net calcium fluoride only. Therefore, the analysis (now standardised) of 85 per cent. calcium fluoride and not to exceed 5 per cent. silica, develops net calcium fluoride of 72½ per cent., after allowing, as established by the leading steel companies, a reduction of 2½ points of calcium fluoride for each point of silica. Calcium fluoride runs evenly in regular practice 85 per cent. or a trifle over, whereas silica, owing to the nature of the deposits of fluorspar, may vary from 1 per cent. to as much as 8 per cent.

A Study of Cupola Lining Refractories.*

BY G. S. SCHALLER, SEATTLE, WASH.

Cupola linings have, for the most part, received less consideration in the modern foundry scheme than any other important foundry raw material. The reason for this condition lies, apparently, in the direction of the foundryman's willingness to accept most any type of fire brick for the cupola because operating conditions and temperatures within the furnace are not fully known. To be sure, fairly accurate data are at hand regarding the operating temperatures, yet information of this type is not complete enough unless it is accompanied by the actual facts of operating conditions such as insulation, load, slags, etc.

The generally-accepted idea of a refractory material is one that will withstand a definite degree of heat. According to the specifications of a refractory material as set forth by the A.S.T.M. the material must have a minimum cone fusion of Seger cone No. 19. The Bureau of Standards in Master Specifications No. 335a, places the softening point at cone No. 31 for fire clay brick, which is the accepted type of material for cupola linings. In defining the term "refractories" two distinct aspects must be kept in mind:—

(1) The resistance to the action of heat without regard to surrounding conditions, and (2) the resistance to the action of heat in actual service. It would seem that the second condition is of the greater importance to the foundryman.

The usual type of fire brick refractories used in the cupola contains a silica (SiO_2) content up to 65 per cent. calculated on dry weight. The other important constituent being alumina (Al_2O_3), which shows a variable content but may be taken at about 25 per cent. minimum. The higher the latter content, the greater the refractoriness of the material considered under paragraph (1) of the definition of refractories. It will be seen, then, that fire clay brick are of the acid type of refractories. This fact is of great importance in studying their behaviour in the cupola.

In order to study the failures in cupola linings, it is necessary to consider completely all operating conditions and note the different types of failures to which the refractories are subjected. Many of these failures are common to installations other than cupolas, consequently the more general types will be considered first.

Failure under Load.

A cupola lining is not seriously affected by load when the lining is installed as segments resting upon brackets spaced at not too great a distance. Theoretically, the only load sustained by any part of the lining is the dead weight of the short column of brick that extends to the next bracket—yet this becomes important at elevated temperatures, especially when the softening range of the brick is approached. The subject of failure under load has been studied by M. C. Booze and presented as technologic paper No. 2 of the American Refractories Institute. Some of the conclusions which Mr. Booze points out are:—(1) "The load test should not be used for determining the suitability of fire clay brick to meet a variety of service conditions," and (3) "deformation is not apt to be an important cause for failure of fire clay brick in a furnace wall and will occur only when a high temperature is developed at a considerable depth in the wall."

This conclusion will explain the reason for cupola lining failures where a cupola is operated for long periods with a heavy lining—that is a cupola "lined down" for decreased capacity. Under such conditions the brick becomes heated more uniformly than where they occur as a single layer against the shell with the result that the fluxing action within the brick takes place over a greater area than the exposed face of the brick, resulting in deformation of the brick.

The question of insulating the melting zone has been raised on several occasions. It can be seen from the above statements that any attempt at preventing radiation through the lining will result disastrously for the lining. It would appear that a much better method of heat conservation would be in the direction of utilising the heat passing up the stack because chances for success would certainly be greater due to higher radiation there than exists at the shell of the melting zone.

Spalling.

No doubt the greatest single cause for cupola lining failure is the result of spalling. Spalling is caused usually by sudden changes in temperature, although the amount of destruction resulting is governed very largely by the texture of the brick. This condition, therefore, goes back to the manufacture of brick. It is generally supposed the bricks made of finely ground clays are more liable to split on alternate heating and cooling than those made of coarse grained material. In the latter type, the strain is relieved by the fissures existing between the larger grains, which, as a rule, are not so continuous as in the finer grained material, thereby preventing a distinct cleavage line. Spalling of brick results from the inability of the brick particles to move freely during relatively sudden temperature changes.

In the cupola spalling will be greatest in the vicinity of the tuyeres due to the entrance of air at room temperatures impinging upon the hottest part of the lining. The directions of the air currents are continually changing because of the shifting of the particles of the charge as well as the metal and slag streams.

The application of daubing mixtures to cupola linings also has an effect upon spalling. In practice it is common to wet the lining thoroughly in order to cause the daubing to stick—there seems to be no alternative to this practice yet it leads to distressing results unless properly handled. When the cupola is rapidly heated before allowing the daubing to dry out completely, steam is generated between the lining and the daubing, which causes the latter material to become dislodged, with the result that the lining is left unprotected in the places where the daubing has been chipped off. This condition gives rise to a further difficulty in that the daubing once laid open through broken patches is weakened and susceptible to abrasion, particularly at the upper part of the melting zone.

Daubing often cracks and falls out upon drying, due to the shrinkage occasioned by the loss of the moisture in the original mixture. This condition can be prevented in a large degree by noting particularly the character of the fire clay forming the base of the daubing mixture. In the case of fat clays it is well to use a large proportion of grog in the daubing mixture. A most satisfactory mixture can be made by grinding used fire brick to about a 12 mesh and mixing with only enough fire clay and water to give the desired bond.

In the preparation of the daubing mixture, care must be given to the selection of the materials used. The fire clay should be of equal quality to the brick and nothing but highly siliceous sand should be employed. The cement should likewise be ground only from fire brick of accepted quality. Dr. Moldenke in "The Principles of Iron Founding," so pointedly remarks about the folly of using local clays in daubing mixtures, yet the writer encountered one cupola in which building sand was employed in addition to the type of clay mentioned above. In this installation the owner complained about excessive slags and short-lived linings, both of which were to be expected under the circumstances.

Salt Washes.

The idea of using common salt (NaCl) as a wash over the daubing mixture has been suggested as a means of forming a glaze over the lining with the idea of increasing the refractoriness as well as the resistance to abrasion. Undoubtedly the practice of using salt for the glazing of ware is successful, yet in a cupola lining a different set of conditions must be confronted. At the elevated temperatures encountered in the cupola lining the salt may volatilise and produce a vapour which when it is condensed will have a corrosive action on the refractory lining by increasing its fusibility.

* A Paper read before the Chicago Meeting of the American Foundrymen's Association. The author is associated with the Department of Engineering Shops, University of Washington.

There is, no doubt, excellent opportunity of increasing the utility of the daubing mixture by the addition of highly refractory materials, preferably of a neutral character. The writer used a heavy coating of carbonaceous material over the daubing mixture during a trial heat in the cupola in the engineering shops at the University of Washington. While the results of a single test are far from conclusive it would appear that improved lining conditions resulted. This experiment was tried mainly as a means of combating fluxing or slag action.

Slag Corrosion.

The reason for lining failures in the melting zone can be traced in a large measure to the corrosive action of the slag. This is readily apparent when the acid nature of fire-clay brick is considered at elevated temperatures, keeping in mind the basic nature of the lime slag. Theoretically, this reaction between an acid and a base should result in the formation of a salt—yet in a cupola the reaction is not so simple, there being other fluxing agents present which add to the complexity of the entire situation. One of these, Fe_2O_3, has been studied by A. H. Kuechler in an article* showing clearly that iron oxide is a potent flux which tends to lower the deformation period of fire-clay refractories. The complex and variable nature of cupola slags makes a detailed study of their corrosive action a difficult subject. Hirsch has found that cupola slags penetrate fire brick chiefly through mechanical action, yet Portland cement has a corrosive action tending to dissolve silica and alumina to form new compounds. The presence of lime (CaO) in fire clay has a known effect upon reduction of the fusion point of the resulting brick. Alkalies vaporise at operating temperatures and are detrimental to fire-clay brick upon condensation of the vapour, according to Searle.

The corrosive effect of slags is also governed by the manner in which the lining is originally laid—large or wide joints permit relatively easy penetration, a condition which is accelerated through the use of inferior clays for lining mortar. A good general rule to follow in this connection would be to use the same kind of fire clay for the mortar that is employed in the manufacture of the brick. In preparing the mortar, it would be well to follow the suggestions outlined under the preparation of the daubing mixture.

Cupola Block Making.

The nature of the brick or cupola blocks used in the lining must also be considered. If they are made of coarse material resulting in considerable porosity, slag penetration is more rapid than where a dense, compact surface is encountered. On the other hand, if the materials are of fine texture and the slag particles are finely divided also, rapid corrosion is bound to result. It would appear, then, that a cupola brick to withstand slag corrosion should be provided with a firm exterior. This result can be obtained in the manufacture of the brick by the pressure exerted upon them, forcing clay-laden water particles to the surface. The importance of a proper surface readily shows up when the lining is picked out, injuring the vitreous surface of the brick; under such circumstances careful daubing is the remedy. The production of a well vitrified surface is also a function of the burning process. Some manufacturers burn the best grades of fire brick twice to produce the desired results. A. Reynolds has an English patent covering a method of increasing the resistance of a brick to corrosion by subjecting the working face of the ware after its first firing to a temperature sufficiently high to produce incipient fusion. The bricks are embedded in the floor of a furnace with their working surface exposed, the spaces between the brick are filled with some highly refractory material such as carbon, etc. The furnace is then heated to produce the desired effect upon the brick.

There are still other sources of slag corrosion which may affect the refractoriness of brick in the cupola. Among these may be mentioned the possibility of sulphur being changed to sulphuric acid (H_2SO_4) whenever moisture is encountered in the fuel. Then, too, the ash content of the slag should not be overlooked. In summing up the reasons for slag action, the presence of lime and alkalies, two potent fluxing agencies, are undoubtedly the main accountable elements.

Cupola linings, unlike many types of metallurgical furnaces, are subjected to deterioration by the abrasive action of the descending charges. This source of failure must be considered from the melting zone to the charging door. The problem presented is not as acute as the one afforded at the melting zone—yet the proper selection of lining material must be considered.

Other elements tending to destroy cupola linings are the cutting action of flames, also the chemical reactions set up through operating both under reducing and oxidation conditions. While the former condition is to be expected, the latter often may be encountered.

The employment of monolithic linings in cupola furnaces appears to be gaining in popularity. There are many attractive features connected with this plan and its broader adoption is being stayed more or less through the old idea that a radical departure from standard practice must be subjected to a thorough probation period. Monolithic linings in boiler furnaces are quite common in this section, although the same thing cannot be said of cupolas. The writer recently had a very satisfactory experience in using a kaolin monolithic lining. This lining was rammed into place—yet it would seem that the adaption of a cement gun for this purpose would give even better results. Particular care in "burning in" had to be given in the case of kaolin because of its highly refractory character. The use of this material in the breast proved a failure for the reason already assigned.

In conclusion, it might be well to mention a word in regard to other possible refractory materials for cupola linings. A study of the equilibrium diagram of the alumina—silica system as prepared by Bowen and Greig of the Geophysical Laboratory will prove of unusual interest. Kaolin (46 per cent. Al_2O_3), sillimite (62 per cent. Al_2O_3), and mullite (71 per cent. Al_2O_3), are materials that would lend themselves very favourably to cupola linings—yet they offer the same objection as the so-called "super-refractories" in that the first cost is so high as to discourage their adoption in place of the usual type of fire-clay brick or cupola blocks.

* Journal American Ceramic Society, Vol. 9, No. 2, Feb., 1926.

Mechanical Handling.

Great progress continues to be recorded in the wide field of mechanical handling in general, and very interesting in this connection is that Messrs. The Underfeed Stoker Company, Limited, of London, have now taken over the representation in Great Britain of all the different handling equipment of the well-known American firm of Messrs. Beaumont.

The field covered by the "Beaumont" specialities is very extensive, and includes the handling of sand, limestone, crushed ores, coal, ash and various other materials, according to many different principles, so that in every case the proper method to suit any particular circumstances can be supplied.

There may be mentioned particularly the "Beaumont" electric driven automatic skip hoist, suitable for all kinds of material, which consists essentially of steel bucket, overhead track cable and winch, the whole operation of the raising and lowering of the bucket from the ground level and the conveyance along the wire cable being controlled by hand from the ground, while the installation includes a special magnetic brake which holds the bucket dead-tight at any point in the travel, in case, for example, of failure of the electric current. Although used for the very largest capacities up to as much as 600 tons per hour, it is equally applicable for much smaller installations and the general advantages of the principle include simplicity, low power consumption since the apparatus generally only works for short periods because of its high duty and the fact that any height can be used.

The Effects of Moisture Absorption on the Properties of Dry-Sand Cores.*

BY H. L. CAMPBELL, Ann Arbor, Michigan.

In order to decrease the number of defective castings due to changes in shape of dry-sand cores when used in green-sand moulds, it is imperative that the effects of moisture absorption on the properties of cores be definitely understood. An investigation has been made to determine the changes in strength and permeability of dry-sand cores when placed in green-sand moulds for different periods of time. In general, cores must have sufficient strength to withstand handling after baking and to resist the forces to which they are subjected when used in moulds. The exact physical requirements of any core are dependent upon all of the conditions under which the core is used. In most cases it is important to provide sufficient bonding strength in dry-sand cores to compensate for the loss in strength due to the absorption of moisture from the moulding sand.

The characteristics of the materials used as core binders vary considerably. Therefore, it has been necessary to determine separately the changes in the properties of cores made with the different types of binders. Core binders may be classified into the following three groups: (*a*) Those binders composed essentially of drying oils which harden mainly by oxidation, (*b*) the pitch and resin binders which become hard when cooled from temperatures which liquefy the binders, and (*c*) those materials which are used in water solutions and become hard by the evaporation of the water. The water-soluble binders include flour from corn or wheat, sulphite liquors from paper mills, molasses, and dextrine. It is reasonable to assume that cores bonded with water-soluble binders would be affected to a greater extent by the moisture absorbed from green-sand moulds, than would other types of binders.

The plan of this investigation was: first, to prepare test cores from definite core-sand mixtures; second, to bake these cores under specified conditions; third, to place the cores in green-sand moulds for definite periods of time; and fourth, to measure the properties of the cores before and after remaining in the moulds for definite lengths of time.

Core-Sand Mixtures.

The core-sand mixtures from which the test specimens were prepared and the temperatures at which the cores were baked are given in the following paragraphs. From each mixture 25 transverse test specimens and 8 permeability test specimens were made in a uniform way on a core-making machine. Only washed and dried silica sand which passed a 60-mesh sieve (size of opening 0.0098 in.) and was retained on a 70-mesh sieve (size of opening 0.0083 in.) was used in the core-sand mixtures.† A small batch mixer of the paddle type was used in the preparation of the different batches. All of the cores were baked for one hour at the desired temperatures. The equipment and procedure for making test specimens, for measuring the transverse strength and for the determination of permeability were the same as used in previous investigations on the properties of core binders.[1] [2]

Mixture No. 1.—In this mixture 1 part by volume of raw linseed oil was used with 50 parts by volume of core-testing sand. Water was added in the ratio of 4 per cent. of the volume of sand. The cores were baked at 220 deg. C.

Mixture No. 2.—In this mixture 1 part by weight of wood resin which was powdered to pass a 140-mesh sieve was used with 25 parts by weight of core-testing sand. Water was added in the ratio of 8 per cent. of the volume of sand. The cores were baked at 180 deg. C.

Mixture No. 3.—In this mixture 1 part by weight of powdered pitch was used with 25 parts by weight of core-testing sand. Water was added in the ratio of 6 per cent. of the volume of sand. The cores were baked at 180 deg. C.

Mixture No. 4.—In this mixture 1 part by weight of cereal binder (a product from corn) was used with 50 parts by weight of core-testing sand. Water was added in the proportion of 4 times the volume of cereal binder. The cores were baked at 180 deg. C.

Mixture No. 5.—In this mixture 1 part by weight of wheat flour was used with 50 parts by weight of core-testing sand. Water was added in the proportion of 4 times the volume of wheat flour. The cores were baked at 180 deg. C.

Mixture No. 6.—In this mixture 1 part by weight of the product obtained by the evaporation of sulphite liquors was used with 50 parts by weight of core-testing sand. This binder contains the soluble resins extracted from wood in the sulphite process for producing pulp for paper making. Fire clay which passed a 200-mesh sieve was used in this mixture in the ratio of 6 per cent. of the weight of core-testing sand. Water was added in the ratio of 8 per cent. of the volume of sand. The cores were baked at 180 deg. C.

Mixture No. 7.—In this mixture 1 part by volume of blackstrap cane molasses having a Baume of 39.7 deg. was used with 50 parts by volume of core-testing sand. Water was added in the ratio of 4 per cent. of the volume of sand. The cores were baked at 110 deg. C.

Mixture No. 8.—In this mixture 1 part by weight of dextrine was used with 50 parts by weight of core-testing sand. Water was added in the proportion of 4 times the volume of dextrine. The cores were baked at 180 deg. C.

Mixture No. 9.—In this mixture 1 part by weight of dextrine was used with 50 parts by weight of core-testing sand. To these materials raw linseed oil was added in the proportion of 1 part by volume of raw linseed oil to 100 parts by volume of sand. Water was added in the ratio of 12 per cent. of the volume of sand. The cores were baked at 200 deg. C.

Methods Used in Obtaining Data.

For each series of tests, four moulds were made in the foundry from iron moulding sand after tempering with water and thoroughly mixing the heap. A pattern was used which produced a cavity 14 in. long, 10 in. wide and 3 in. deep inside a two-part flask. A sample of the sand used in making each mould was taken for the determination of moisture.

Trays made of heavy wire screen were provided for supporting the cores within the green-sand moulds. On each tray, 5 transverse test cores and 2 permeability test cores were placed, after carefully weighing the cores. The cores were not allowed to touch the mould surfaces, but were exposed on all sides to the atmosphere within the moulds. The test cores were left in the closed moulds for periods of 4, 8, 12 and 24 hours. At the end of each period, a tray of cores was removed from one of the moulds. The cores were weighed and the transverse test specimens were broken on the testing machine. Permeability values were obtained before placing the cores in the moulds and immediately after removing from the moulds.

Effects of Moisture Absorption on Transverse Strength.

The results obtained from the tests of cores which were placed in closed green-sand moulds for definite periods of time are given in Table I. Each value in the table is the average of the transverse strength of at least five test specimens. This information is representative of conditions affecting the use of dry-sand cores in general foundry practice. The average moisture content of the sand used in making the moulds in which the cores were placed was 7.2 per cent. by weight.

In order to determine whether the proportion of moisture in moulding sands affects the changes in properties of dry-sand cores, some test specimens prepared from mixture No. 4 were placed

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* A Paper read before the Chicago Meeting of the American Foundrymen's Association. The author is Assistant Professor of Metallurgical Engineering, University of Michigan.

† Obtained from the Standard Silica Co., Ottawa, Ill.

[1] Campbell, H. L., "The Qualities of Commercial Core Oils," Trans. American Foundrymen's Association, Vol. 33, 1926, pp. 72-82.

[2] Campbell, H. L., "Methods for Determining the Properties of Cores Made With Cereal Binders," Trans. American Foundrymen's Association, Vol. 34, 1927, pp. 558-566.

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in moulds made from sands containing 5.1, 7.8 and 11.1 per cent. moisture. At the end of eight hours, the cores were removed and their average transverse strengths were found to be 13, 12 and 13 lbs. These results indicate that the moisture content of the sand in moulds does not control the change in strength of the dry-sand cores when placed in the moulds. It is probable that the cavity within a green-sand mould soon becomes saturated with moisture, irrespective of the exact moisture content of the sand.

The average decrease in strength of each set of dry-sand cores after remaining for a definite period in a green-sand mould is given in Table II. From these data it is possible to note the characteristics of the different binders when exposed to moist atmospheres. Cores made from mixture No. 7 were too soft to be handled after remaining in a green-sand mould for four hours.

TABLE I.—*Average Transverse Strength of Cores Before and After Placing in Green-Sand Moulds.*

Mix no.	Binder.	Before placing in mould.	After 4 hours in mould.	After 8 hours in mould.	After 12 hours in mould.	After 24 hours in mould.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	Raw linseed oil	61	39	37	34	29
2	Powdered rosin	31	29	29	28	26
3	Powdered pitch	12	5	4	4	Less than 3
4	Cereal (from corn)	52	18	13	11	11
5	Wheat flour	19	7	6	4	0
6	Sulphite liquor	55	22	13	8	4
7	Blackstrap molasses ..	35	0	0	0	0
8	Dextrine	20	10	0	0	0
9	Dextrine and raw linseed oil	63	34	12	6	Less than 3

2. The permeability or venting property of dry-sand cores is not changed on exposure to moist air for periods of time up to 24 hours.

3. The amount of moisture absorbed by dry-sand cores from closed green-sand moulds is relatively small.

This investigation on one of the characteristics of dry-sand cores is part of a research programme including the study of core sands, binders and practice which is supported by certain foundry interests in Michigan and directed by the Engineering Research Department of the University of Michigan.

TABLE II.—*Percentage Loss in Transverse Strength of Dry-Sand Cores in Green-Sand Moulds.*

Mix no.	Binder.	After 4 hours in mould.	After 8 hours in mould.	After 12 hours in mould.	After 24 hours in mould.
1	Raw linseed oil	36	39	44	52
2	Powdered rosin	6	6	10	16
3	Powdered pitch	58	67	67	75
4	Cereal (from corn)	65	75	79	79
5	Wheat flour	63	68	79	100
6	Sulphite liquor	60	76	85	98
7	Blackstrap molasses	100	100	100	100
8	Dextrine	50	100	100	100
9	Dextrine and raw linseed oil ..	46	81	90	95

Mixture No. 9 was included in the series to ascertain whether raw linseed oil protects the water-soluble binder in the cores from rapid deterioration of strength due to the absorption of moisture. It was found that the strength of these cores decreased more rapidly than was characteristic of cores bonded with raw linseed oil alone.

Effects of Moisture Absorption on Permeability of Cores.

The permeability of a core is the measure of the rate at which gases will pass through the core. Permeability values were obtained from cores bonded by different binders and exposed to green-sand mould conditions for different periods of time. It was found in every case that the permeability values of cores prepared from a given mixture were practically the same before and after being exposed to the moist air within green-sand moulds.

Moisture Absorbed by Dry-Sand Cores.

The amount of moisture absorbed by cores from the air within the green-sand moulds is very small. The increase in weight of cores bonded with raw linseed oil after remaining in a green-sand mould for 24 hours amounted to 0.13 per cent. of the weight of the cores before placing in the mould. Cores bonded with pitch or resin had a maximum gain of 0.18 per cent., while cores made with water-soluble binders absorbed less than 1 per cent. by weight of water in a 24-hour period. The tendency is for the moisture absorbed to increase with the length of time during which dry-sand cores remain in green-sand moulds.

Conclusions.

1. The strengths of dry-sand cores are decreased when the cores are exposed to moist air. The extent of this deterioration in strength is dependent on the type of core binder used in making the cores and the length of time the cores remain in the moist atmosphere. The importance of storing all cores in dry places and of limiting the length of time during which dry-sand cores remain in green-sand moulds is apparent from the results of this investigation.

Catalogues Received.

Foundry Equipment.—In fulfilment of a promise by Mr. John Hill made to us during a recent visit to Europe, we have received from his firm, the Hill and Griffith Company, of 1,244, State Avenue, Cincinnati, Ohio, U.S.A., a copy of their General Catalogue and Price List, No. 14. It contains over six hundred pages, and is magnificently bound in embossed blue card box decorated with a gold medallion. It is probably the most elaborate catalogue of its kind issued to the foundry trades. The main business of this company is apparently the importation of graphite into the United States, and from it the preparation of foundry facings, but undoubtedly it must conduct a very important business as merchants of general foundry equipment and supplies, as one finds interspersed illustrated descriptions of such well-known products as Sterling boxes. The arrangement of the book, we believe, could be improved to advantage, as we find "Useful Data," details of the firm's important and modern laboratory testing equipment (chemical, physical and micrographical), and blowers, ungrouped and interspersed throughout the text. The effect of this is somewhat ameliorated, however, by the inclusion of an excellent index.

Instead of any telegraphic code figure numbers run consecutively throughout the book. Such a system may be satisfactory for American conditions, but we doubt if it would prove as useful under British, when applied to a firm of similar standing. Finally, we sincerely thank Mr. Hill for sending us along what we feel sure is the most beautiful and comprehensive catalogue of foundry equipment and supplies that has ever come into our hands.

XUM

Safety in Factories and Workshops.

In a circular letter dated May 16, 1927 (Ref. No. 508,254), addressed to "Employers' Associations Concerned," and referred to in a leading article recently, the Under-Secretary of State, Home Office, states that he is directed by the Secretary of State to inform the Associations that he has been much concerned to learn from the Chief Inspector of Factories that progress in the development of safety-first arrangements in factories continues to be disappointingly slow. As he has pointed out in Parliament and elsewhere, the need of such arrangements—in industry as elsewhere—is great. The total number of accidents reported to the Factory Department shows no sign of any substantial reduction, and while a certain proportion of these accidents are preventible by fencing and similar mechanical precautions which can be made the subject of specific regulation, experience shows that the majority—perhaps in some cases as much as 60 per cent.—are due to other causes which are not susceptible of being dealt with in this way. It appears, therefore, to Sir William Joynson-Hicks that the chief, if not the only, hope at present of effecting any substantial reduction in the total number of accidents lies in a much closer and more comprehensive measure of supervision being exercised at the individual factories in regard to all matters affecting safety, and, so far as he can see, such supervision can only be secured through the establishment at the works of special safety organisations which would ensure that the circumstances and causes of all the accidents occurring in the factory are closely investigated and the best methods of carrying on work with safety carefully studied, that the workers are instructed in the risks and imbued with safety-first principles, and generally that all practicable means are taken for the promotion of safety methods in the factory.

How much can be accomplished in this way is proved beyond all doubt by the experience of certain firms which have established safety-first organisations in their works. Particulars of such cases have been given in the Chief Inspector's Annual Reports from time to time. The examples quoted by "Safety First," the journal of the National Safety First Association, which are set out in the Chief Inspector's Report for 1925, are typical of what can be achieved. The journal states that Messrs. Thos. Firth & Sons have reduced their frequency rate (*i.e.*, the number of lost-time accidents per million hours worked) from 50 in 1919 to 27 in 1925, and their severity rate (number of days lost per thousand hours worked) from 3.05 in 1919 to 0.564 in 1925. Messrs. Edgar Allen & Company, Limited, have secured a 50 per cent. reduction in their accident rate since the adoption of Safety First methods. Messrs. C. T. Skelton & Company, Limited, have reduced their severity rate from 1.32 in 1922 to 0.40 in 1925, and Messrs. Steel, Peech & Tozer, Limited, had achieved a reduction in the same period from 5.06 to 2.5.

Notwithstanding, however, the excellent results obtained in these and similar cases, the Secretary of State regrets to learn that the example is not being widely followed, and that there is no sign, even in the chief accident-producing industries, of any voluntary movement on the part of the employers generally to grapple with this question. Accordingly he has felt it his duty to consider whether he should not, in default of voluntary action on the part of the industries themselves, exercise the compulsory powers which are conferred on him by Section 29 (3) of the Workmen's Compensation Act, 1923. After quoting that section the Under-Secretary of State mentions the fact that these powers were expressly enacted by Parliament for the purpose of promoting the establishment of special safety organisations in factories, and the Secretary of State feels that in the circumstances above mentioned he ought not to delay any longer in bringing these powers into operation. He has, accordingly, provisionally approved the issue of an order on the lines shown in the draft enclosed with the circular letter to provide for the institution of special safety arrangements in the chief accident-producing industries (excepting, for the present, docks).

Before proceeding, however, to make the order, the Secretary of State desires to give the Employers' Associations in the industries affected by the order the opportunity to submit their observations on the proposals, with a view in particular to ascertaining whether the employers in any of these industries would not be prepared voluntarily to take the necessary steps to establish arrangements of the kind contemplated in the order at their works. If he were assured that the employers in any of the industries concerned were ready to adopt effective safety schemes on the lines indicated in the order (or on such other lines as may be approved) and that effective steps would be taken without delay to institute such arrangements, he would be quite willing, so far as that industry was concerned, to postpone the issue of the order in order to give the employers the opportunity of dealing with the matter on a voluntary basis.

As regards the terms of the draft order, it is proposed to require the employment by the occupier of a competent safety supervisor, responsible directly to the occupier, and charged with the various duties in regard to safety set out in the draft. It will, however, be noted that the order is of an elastic character, and that every occupier will have the opportunity of substituting, with the Chief Inspector's approval, a special safety scheme adapted to the particular circumstances of his works. He will also be able to claim exemption altogether from the order if he can satisfy the Chief Inspector that other not less effective measures for the prevention of accidents have been adopted.

According to Clause 2 of the draft rules the order will apply to the following classes of factories:—(i) blast furnaces for smelting iron ore; (ii) iron and steel rolling mills, including tube works; (iii) the following engineering works (in which more than 500 persons are employed):—Forges, engine-building, making of transmission machinery, constructional engineering, hydraulic engineering, electrical engineering (making of dynamos and motors, and cable making), making of agricultural and industrial machinery, making of railway, tramway and motor vehicle plant, ordnance works; (iv) iron foundries in which more than 50 persons are employed; (v) shipbuilding works.

Steel foundries, it will be seen, are not mentioned, nor foundries turning out non-ferrous castings.

The next three clauses of the draft rules refer to the appointment of a Safety Supervisor, and are to the following effect:—

Clause 3.—(1) The occupier of any factory to which this order applies may submit for the approval of the Chief Inspector of Factories a scheme for special supervision in regard to safety, investigation of the circumstances and causes of accidents in the factory, and generally the promotion of safety in the factory.

(2) If no such scheme is approved in respect of any factory, the occupier of the factory shall employ a competent Safety Supervisor who shall be responsible directly to the occupier (or, in the case of a company, the managing director), and whose sole duty it shall be:—

(*a*) to maintain a constant supervision over the works, ways, machinery and plant in regard to their safety, to notify to the responsible heads of departments and to the occupier any defects observed, and to report generally to the occupier as to the methods by which the work can be carried on in the safest possible manner:

(*b*) to arrange for and supervise the training of workers newly engaged or transferred to new processes;

(*c*) to investigate every accident occurring in the factory, which is notifiable to the Factory Inspector under the Factory and Workshop Acts, as soon as possible after the occurrence, and to enter the results of his investigation in a book kept for the purpose;

(*d*) in concert with the management and the operatives or their representatives, to organise ways and means of instructing the operatives in the risks attending their work and inculcating "safety-first" principles;

(*e*) to see that all devices or appliances for protection against accident, and in particular appliances for stopping machinery when an accident has occurred, are in proper order, and their use and working understood by the operatives concerned;

(*f*) to see that the first-aid and ambulance arrangements are maintained in an efficient state and that if possible a sufficient number of the operatives in

each department of works are trained and exercised in first-aid and ambulance work.

Clause 4.—A record of every investigation made in pursuance of the preceding clause, duly signed and initialled by the Safety Supervisor, shall be posted up in the works and kept in the form prescribed by the Secretary of State and shall include the following particulars—(i) date and hour of investigation; (ii) details as to the cause of the accident; (iii) names and addresses of witnesses (if any); (iv) precautions recommended to prevent similar accidents, and (v) the action taken on such recommendations. The record shall be available for inspection by the Factory Inspector.

Clause 5.—The occupier shall prepare and forward to the District Inspector at the end of each year a summary of accidents for the factory. Such summary shall be in a form prescribed by the Secretary of State, and shall furnish the prescribed particulars showing the rate of accidents according to the number of persons employed and time worked, and the amount of working time lost as the result of such accidents.

Cutting Salamanders and Heavy Masses of Iron with an Oxygen Lance.*

BY E. E. THUM.

The author outlines methods whereby large masses or blocks of iron or steel may be cut to handling size. Such "white elephants" arrive from time to time at every furnace plant, and often must be handled with the minimum of delay. Salamanders, furnace bottoms, bad spills, heavy ladle skulls, huge ingots, or big blocks of iron or steel are instances. Very often it is impossible to blast these apart, because of the danger to surrounding structures; often the metal is full of half-burned coke or layers of slag, or far too thick for an ordinary oxy-acetylene cutting blowpipe. All such masses of metal, clean or dirty, to any thickness yet encountered, can be drilled by an oxygen lance at high speed, or in conjunction with a cutting blowpipe, can be cut across bodily without the aid of explosives.

An oxygen lance consists essentially of a steel pipe, passing a stream of pure oxygen. Obviously a source of supply and flexible connections are also part of the equipment. Heavy equipment requires much oxygen. Therefore five cylinders are ordinarily connected to an appropriate manifold, to assure that failure in gas supply will not occur at an inconvenient time. Initial pressure in these cylinders is high—2,000 lbs. per sq. in. This must be reduced and controlled for the purpose in hand, which is done by connecting to the discharge end of the manifold a "manifold regulator," consisting of a pressure-reducing valve capable of being set to deliver at given pressures. It is equipped with suitable gauges, showing the pressure in the cylinders and at the discharge side of the regulating device.

For hose, 7-ply oxygen hose, ¼ or ⅜ in. diameter, 50 ft. long, will ordinarily be ample. Armoured hose must be avoided, because if for any reason it should burst, small fragments of the wrapping are thrown about. Plain rubber hose merely opens up. Pneumatic hose and fittings are also unsuitable. It is essential that "oxygen" should always be clearly distinguished from "air"—several bad accidents have occurred because of this confusion in names. If pneumatic fittings are used, sooner or later some old or oily hose from air-hammer or other pneumatic equipment will be connected to an oxygen supply and a burst or burned hose will result. It should be remembered that oil or grease will burn spontaneously if struck by pure compressed oxygen.

A handle, consisting of a piece of bent 1-in. pipe, is desirable to enable the operator to stand to one side of the lance. The handle should end in a bushing for the lance pipe. The size and kind of pipe varies according to the duty. Ordinarily standard ¼-in. steel pipe is used. Each length should have a coupling and free running thread so that a burned-off pipe may be replaced with the minimum delay. It should also be free of oil and grease; the best way is to place it on a hot steel runner or slag ladle until it gets red hot from end to end. Then blow out the char with clean compressed air.

The lance penetrates iron or steel by virtue of fact that if this metal is heated to a bright red, it will burn in pure oxygen, generating enough heat to keep the combustion going and to melt the resulting oxide into a liquid slag. The action is focussed at the end of the lance pipe, and consequently a hole can be pierced in any direction by merely advancing the lance in the right direction. If a layer of slag is encountered, the lance pipe itself burns, furnishing the necessary heat and flux to melt through the slag. Nothing stops it.

"Salamanders" are found in both blast furnaces and open-hearth furnaces, possibly more extensive in the former, but often a very big, tough chunk of steel and lining underlies the open-hearth bottom. These "salamanders," so called, must be broken up and removed before reconstruction of the furnace can begin. Nearly always this is a "rush" job. It is done by drilling the mass and blasting it into pieces small enough to drag out. Sometimes it may be cut apart by a combination of cutting blowpipe and oxygen lance. When it has been decided to drill blast holes with an oxygen lance, it is not even necessary to wait for the salamander to get cold. A working scaffold can be built and burning started as soon as the furnace walls are torn down. In fact, it is obviously a distinct advantage to burn into hot metal; the combustion is more rapid, the fire never "blows out," and since there is always hot iron to burn at the bottom of the hole, an iron pipe sheathed in hardwood, or even a copper pipe, can be used for a lance. However, it is advisable to have a rivet forge and a supply of double-strength iron pipe handy, in case the hole strikes a mass of slag or firebrick enclosed in the main mass, when some burning iron will be necessary to provide heat and flux to pierce it.

Drilling by a lance is very rapid. Not more than two minutes' actual burning time is required to sink a hole 2½ in. diameter, 1 ft. deep, into a hard mass of metal. Burning is interrupted three or four times, however, to renew the burned-off pipe, so it may require five minutes to sink a hole 1 ft. deep. To do it consumes at the most 45 ft. of ¼-in. pipe and 100 cub. ft. of oxygen. (These figures are for piercing the dirtiest cast iron with gas pressures at the regulator as high as 90 lbs. per sq. in.)

While a saving of a substantial sum in labour and material may be made by drilling a salamander with oxygen, instead of using other methods, it is the saving in time in getting a furnace back into blast which really counts. Whereas 60 days used to be the allowance for major repairs on a blast furnace, this time has now been cut to 45 days. These 15 days may be saved largely by saving the delay required to cool the salamander and to drill it by antiquated methods. Similar economies are possible in open-hearth repairs.

* "The Blast Furnace and Steel Plant."

New Companies.

Brockbank & Powell, Limited, Palace Chambers, Bridge Street, Westminster, S.W.1.—Capital £2,100 in 2,000 5 per cent. non-cumulative preference shares of £1 and 2,000 ordinary shares of 1s. Engineers. Directors: C. J. Brockbank and H. H. Powell.

Broomwade Compressor Hirers, Limited, Desborough Iron Works, High Wycombe, Bucks.—Capital £11,000 in 10,000 7 per cent. cumulative preference shares of £1 and 20,000 ordinary shares of 1s. Machinery dealers.

M. Henderson, Clark, Limited, Commercial Buildings, Wilson Street, Middlesbrough.—Capital £3,000 in £1 shares, to acquire business of iron, steel and metal merchant carried on by A. Clarke at Commercial Buildings, Wilson Street, Middlesbrough, as Clarke Bros. Directors: M. H. Clark, 65, Wellesley Road, Middlesbrough; W. Clark, 4, Stanhope Gardens, Belle Vue Grove, Middlesbrough; and Mrs. E. Clark, 65, Wellesley Road, Middlesbrough.

The Northumberland Shipbuilding Company (1927), Limited, Northumberland Shipyard, Howdon-on-Tyne.—Capital £10,000 in £1 shares.

Still Locomotive Syndicate, Limited, Church Wharf, Chiswick, W.4.—Capital £1,000 in 1s. shares, to obtain from Still Engine Company licence to make certain patents owned by Still Engine Company relating to Still engines.

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"TEAM" PATENT COKE

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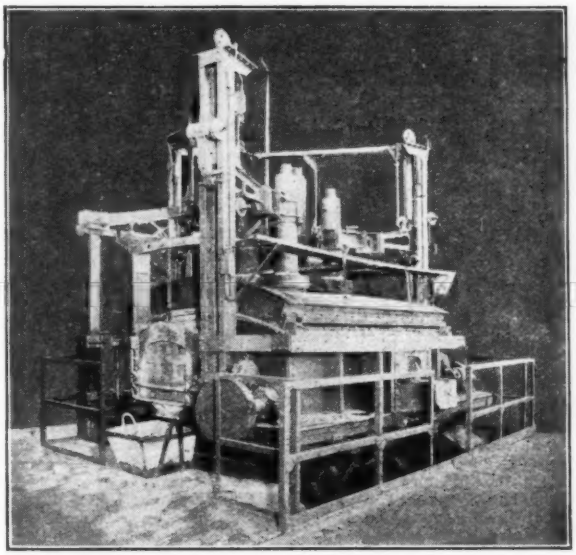

NON-FERROUS METAL MELTING ELECTRIC FURNACES — SINGLE, TWO, or THREE PHASE.

CONTRACTORS TO HOME AND FOREIGN GOVERNMENTS.

WATSONS (METALLURGISTS) LIMITED

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GANISTER, CUPOLA BLOCKS, FIRE BRICKS,

FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & Co., Ltd.

DEEPCAR, nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

Trade Talk.

A FIRE BROKE OUT on June 18 at the Soho Works of W. & T. Avery, Limited, Smethwick, but the damage was not heavy.

STANDARD AND OSWALD STOTT (ENGINEERS), LIMITED, Evington Valley Road, Leicester, will in future be known as the Standard and Pochin Bros., Limited.

THE PRIOR FIELDS FOUNDRY, Deepfields, Staffordshire, which has a goodwill extending over a hundred years, has been sold by auction for £3,000 to Mr. J. Norton, of Ladymoor.

THE NATIONAL GAS ENGINE COMPANY, LIMITED, Ashton-under-Lyne, have moved into new offices and showroom in London, the address being 117, Queen Victoria Street, London, E.C.4.

BOLCKOW, VAUGHAN & COMPANY, LIMITED, have decided to change one of their blast furnaces at South Bank now making Cleveland pig-iron over to the production of ferro-manganese.

G. R. CAWOOD & COMPANY, LIMITED (Coal and Coke Department), 1, Cavendish Road, Leeds, inform us that as from July 4 they are opening a London office at 200, High Holborn, London, W.C.1. Telegrams: Ocawoods Westcent London. Telephone: 0582-3.

THOUGH THEIR PRICE was somewhat higher than that quoted by Continental competitors, Cochrane & Company, Limited, of Middlesbrough, have secured a contract for the supply of two and a-quarter miles of 15 in. cast-iron pipes for a new gas main at Redcar.

WE ARE INFORMED by the secretary of the Society of Engineers that, owing to the generosity of a member of the Society, three special yearly premiums of £10 10s. each have been provided for the classes of members, associate members and associates respectively of the Society, for three years. In each class the premiums will be awarded for the best paper submitted before November 30, 1927.

THE POWER GAS ECONOMY COMPANY, 50, Wellington Street, Glasgow, have just received the order for the supply of the first large installation of gas burners and pressure controllers to be installed in this country, in which pre-heated air is used to burn blast furnace gas in a whole battery of boilers. Fourteen Lancashire boilers are to be fitted with "Hunter" gas burners, and the supply of pre-heated air to the burners is to be controlled according to the variations of gas pressure by two "Hunter" regulators. The installation is for the Wigan Coal and Iron Company, Limited, who, we understand, are arranging to pre-heat the air by means of two large "Supermisers" made under Leek's patents.

CONSTRUCTIONAL ENGINEERING COMPANY, "Titan" Works, Birmingham, have received during the last few weeks orders for the following plant:—Austin Motor Company, Northfield, cupola, fan, etc., sand dryer (repeat order); Combustion Engineering, Limited, Derby, 7 ft. dia. cupola, melting 14 tons per hour (repeat order); Southern Foundries, Limited, Croydon, 7 ft. dia. cupola, fan and motor, staging, ladles, etc.; Merrington Bros., Clapton, London, E., complete melting equipment, cupola, fan and motor, etc.; Mackenzie & Moncur, Limited, Edinburgh, No. 6 "Titan" cupola, complete with spark arrester, etc. The company are also supplying a complete melting equipment for abroad, consisting of cupola, staging, fan, hoist, etc.

SIR ALLAN SMITH, chairman of the Management Board of the Engineers' and Allied Employers' National Federation, in an address at a luncheon given by the London Commercial Club, said that he was afraid that in these times of stress little or no attention was paid to the difficulties of industry, especially of those which were producing capital goods and not goods for consumption. They were often working under difficulties unknown and unimagined. Questions to be asked were where was the money to come from, and was it really revenue or capital that was being spent. The rates of pay of the highly trained mechanic bore a disgraceful comparison with those of scavengers employed by municipalities, who often received double what was paid to the engineers who rendered those wages possible. The net returns of about £200,000,000 sterling of output were last last year about 2 per cent. on its turnover and nearly the same percentage on the capital, and the shareholders had to be content with that while the workpeople took 30 per cent. During the war engineers were compelled to build large extensions to their workshops which could not be fully employed in times of peace, and they were now forced to pay rates on those unoccupied buildings. It might be said that local rates had been reduced, but increased assessments had more than counter-balanced that. Referring to foreign competition, he said it was unfair that British manufacturers were saddled by municipalities with a "fair wages" clause, foreigners being exempt.

Company Reports.

Greenwood & Batley, Limited.—Dividend, 2½ per cent., making 5 per cent. for year.

Tata Iron and Steel Company, Limited.—Dividend on ordinary shares, 2 rupees 4 annas.

R. Hood Haggie & Son, Limited.—Interim dividend, 10 per cent. per annum, less tax, on ordinary shares.

John Brown & Company, Limited.—Appropriated from contingency account, £175,000; net profit, £6,589; preference dividend paid; carry forward, £111,272.

Burntisland Shipbuilding Company, Limited.—Loss for year, £11; debit balance brought forward; directors' fees, £1,080; balance at debit of profit and loss account, £1,091.

James Keith and Blackman, Limited.—Available balance, £40,426; dividend on ordinary shares, 12½ per cent., less tax; reserve account, £8,000; carry forward, £12,426.

William Cooke & Company, Limited.—Net loss for year, after providing for depreciation, £11,375; amount brought forward, £6,427; debit balance to carry forward, £4,947.

Edgar Allen & Company, Limited.—Profit, £13,337; brought in, £35,353; total, £48,690; dividend, 9d. per share on ordinary shares, free of tax (3¾ per cent.); carry forward, £18,374.

J. & G. Wells, Limited.—Profit, £18,195; brought in, £36,108; year's preference dividend; available, £51,213; ordinary dividend, 2½ per cent., less tax, for year; carry forward, £44,963.

Platt Brothers & Company, Limited.—Net profit, £257,582; final dividend, 7½ per cent., making 10 per cent. for year, less tax; carry forward, £85,080, against £83,911 brought forward.

Ransomes, Sims and Jefferies, Limited.—Profit, £18,887; brought in, £58,599; available, £77,487 less dividend on preference; no dividend on ordinary; reserve, £10,000; carried forward, £56,487.

Marshall, Sons & Company, Limited.—Loss, £33,806; total deficit, £53,427; transferred from reserve, £65,000; balance brought forward, £23,245; preference dividend paid; carried forward, £2,818.

Dorman, Long & Company, Limited.—Directors have decided to pay no dividend on non-cumulative preferred ordinary capital; also to defer consideration of payment of dividend on cumulative preference shares.

Horseley Bridge and Engineering Company, Limited.—Trading loss for year, £10,398; amount brought forward, £6,042; net debit balance, £4,356; transferred from reserve, £10,000; credit balance, £5,643, carried forward.

Ransomes & Rapier, Limited.—Loss for year, £12,054; disposable balance, after providing for all outgoings, depreciations, interest on debentures, etc., £11,176; dividend, 6 per cent. on preference shares, less tax; carry forward, £10,431.

Falkirk Iron Company, Limited.—Net profit, £38,599; balance brought forward, £31,201; depreciation, £10,000; final dividend, 5 per cent. (less tax) on ordinary shares, making 10 per cent. (less tax) for year, including increment to employés' shares; carried forward, £35,596.

Butterley Company, Limited.—Net profit, £400,592; with balance brought forward total stands at £476,323; interim dividends, free of tax, £60,000; final dividend, 4d. per share and bonus 1s. 8d. per share, free of tax, £120,000; transferred to general reserve fund, £215,572; carried forward, £80,750.

Stanton Ironworks Company, Limited.—Profit, £234,617; balance from last account, £148,700; total, £383,317; interest on 4½ per cent. mortgage debenture stock paid or accrued, £45,000; dividend on preference shares for half-year, £10,744; interim dividend, 4 per cent. on ordinary shares, free of tax, £45,468; final dividend on preference shares for half-year, less tax, £10,744; final dividend, 6 per cent. on ordinary shares, free of tax, £68,202; reserve for depreciation of new works, £50,000; carried forward, £153,159.

Obituary.

THE DEATH HAS occurred at Great Crosby, Liverpool, of Mr. J. W. Stones, engineer at the Distington Ironworks. Mr. Stones gained his early engineering experience in the North Lonsdale Iron and Steel Company, and after a period at sea, he became engineer at the Distington Ironworks about nine years ago. Highly capable and painstaking in the discharge of his duties, he gained the esteem of his directors and all with whom his work brought him into contact. He made many friends, and his death brings to a close a very promising career.

THE ANNUAL CONFERENCE

OF THE

INSTITUTION of BRITISH FOUNDRYMEN

WILL BE HELD

NEXT WEEK

AT

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WELCOME TO SHEFFIELD!

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—As has been the custom for generations past at midsummer, work in the Cleveland iron industry has been practically suspended during the local race celebrations and the succeeding week, while markets have been in a corresponding idle condition. The outlook, however, may be regarded as a little more hopeful, the existing slackness being almost entirely due to foreign competition. Home consumption is on a fairly substantial scale, but Cleveland producers have of late lost practically the whole of their once extensive export trade, and have even had to share the home market with the foreigner. All the year prices have been falling, and, as usually happens on a drooping market, buyers have held off, being content to buy from hand to mouth. Tees-side furnaces, however, still adhere quite firmly to the agreed minimum price list, as follows:—No. 1 Cleveland foundry iron, 72s. 6d. per ton; No. 3 Cleveland G.M.B., 70s.; No. 4 foundry, 69s.; No. 4 forge, 68s. 6d. per ton, f.o.t. or f.o.b.

In the East Coast hematite market, although still encumbered with heavy stocks in hand, the position is no worse than a week ago, and probably a little better, and there are more inquiries circulating for moderately large quantities. East Coast mixed numbers are quoted round about 77s. 6d. per ton, and No. 1 78s. On the North-West Coast prices are unaltered, Bessemer mixed numbers being quoted at £4 8s. per ton delivered at Glasgow, £4 12s. 6d. per ton delivered at Manchester, £4 14s. per ton delivered at Sheffield, and £4 15s. to £4 17s. 6d. per ton delivered at Birmingham.

LANCASHIRE.—Local demand for foundry pig in this district continues on the quiet side, buying being confined, as hitherto, more to immediate requirements than to forward transactions in bulk. Quotations, delivered equal Manchester, rule about as follow:—Derbyshire No. 3, 78s. per ton; and Scottish No. 3, from 96s. to 110s. per ton.

THE MIDLANDS.—At Birmingham recently buying on foundry account has been slightly more active than previously reported, but a further improvement would be acceptable to local producers. Quotations rule about as follow:—Derbyshire No. 3, 70s.; Northamptonshire, 65s.; and Staffordshire No. 3, 68s. to 70s., all at furnace.

SCOTLAND.—The Scotch pig-iron market is, if anything, quieter, and the price of No. 3 foundry is not over 79s. at furnaces. As usual on a falling market, consumers will not be tempted to book ahead, and are only buying trivial quantities for which, however, there is the keenest competition.

Steel.

At Sheffield the demand for acid and basic billets shows a dwindling tendency, and there is nothing to suggest an early revival. Much of the open-hearth steel now produced is being placed in stock. The demand for crucible steel shows some improvement, and manufacturers of special steels have some good orders. Heavy engineering and motor steel branches are well employed locally, and generally there is a broadening tendency in trade in this district, which must inevitably lead in time to greater activity in the steel market. Conditions in the tinplate market continue depressed, and there is no indication of improvement; works are short of orders and are keenly competing for the small volume of business passing.

Metals.

Copper.—Alternative periods of strength and weakness now appear the rule in the standard copper markets, movements being usually influenced by American interests operating outside of the combine. European trade continues more or less handicapped by the fact that American consumers have the advantage of a free open market on terms more favourable than those with which European users have to contend.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £54 2s. 6d. to £54 3s. 9d.; Friday, £53 17s. 6d. to £53 18s. 9d.; Monday, £53 15s. to £53 16s. 3d.; Tuesday, £53 13s 9d. to £53 15s.; Wednesday, £53 10s. to £53 11s. 3d.

Three Months: Thursday, £54 15s. to £54 16s. 3d.; Friday, £54 8s. 9d. to £54 10s.; Monday, £54 7s. 6d. to £54 8s. 9d.; Tuesday, £54 7s. 6d. to £54 8s. 9d.; Wednesday, £54 3s. 9d. to £54 5s.

Tin.—During the past week the market for standard tin has again recovered the £300 level in values, the advance having been stimulated by active American buying in London, and also in the East, while fair quantities have been purchased on Continental account, although the home demand is restricted. The position of cash tin continues tight, with home stocks again reduced to a dangerously low level, but some professional selling on the part of prominent interests led to a temporary setback, although later prices firmed up again, so that the loss is comparatively small.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £300 15s. to £301; Friday, £297 15s. to £297 17s. 6d.; Monday, £300 15s. to £301; Tuesday, £296 5s. to £296 15s.; Wednesday, £297 15s. to £297 17s. 6d.

Three Months: Thursday, £287 5s. to £287 10s.; Friday, £286 to £286 2s. 6d.; Monday, £285 15s. to £286; Tuesday, £284 15s. to £285; Wednesday, £285 15s. to £285 17s. 6d.

Spelter.—The market for ordinary spelter has of late developed a firmer tendency than other sections of the non-ferrous group, an improvement due in a measure to rather more favourable advices from the Continent, where it is reported that a better demand on the part of consumers has been experienced.

The following are the week's prices:—

Ordinary: Thursday, £28 6s. 3d.; Friday, £28 5s.; Monday, £28 8s. 9d.; Tuesday, £28 3s. 9d.; Wednesday, £28 7s. 6d.

Lead.—Soft foreign pig has again been depressed under a lack of trade buying, and fresh selling against orders maturing, while metal has been tendered pretty freely. The outlook in this metal is still poor, chiefly on account of the heavy surplus hanging over the market.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £24 12s. 6d.; Friday, £24 7s. 6d.; Monday, £24 5s.; Tuesday, £24; Wednesday, £23 17s. 6d.

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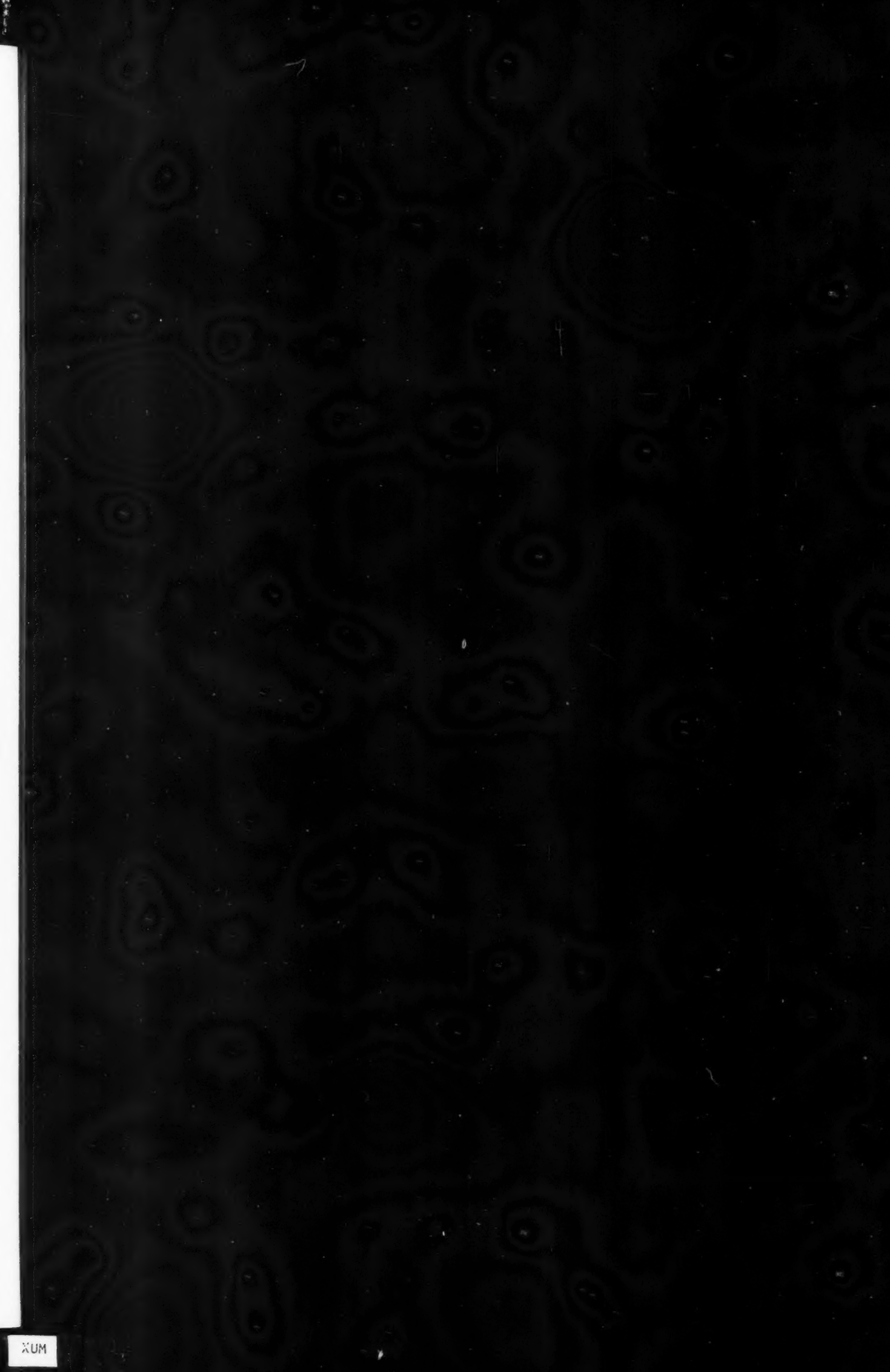

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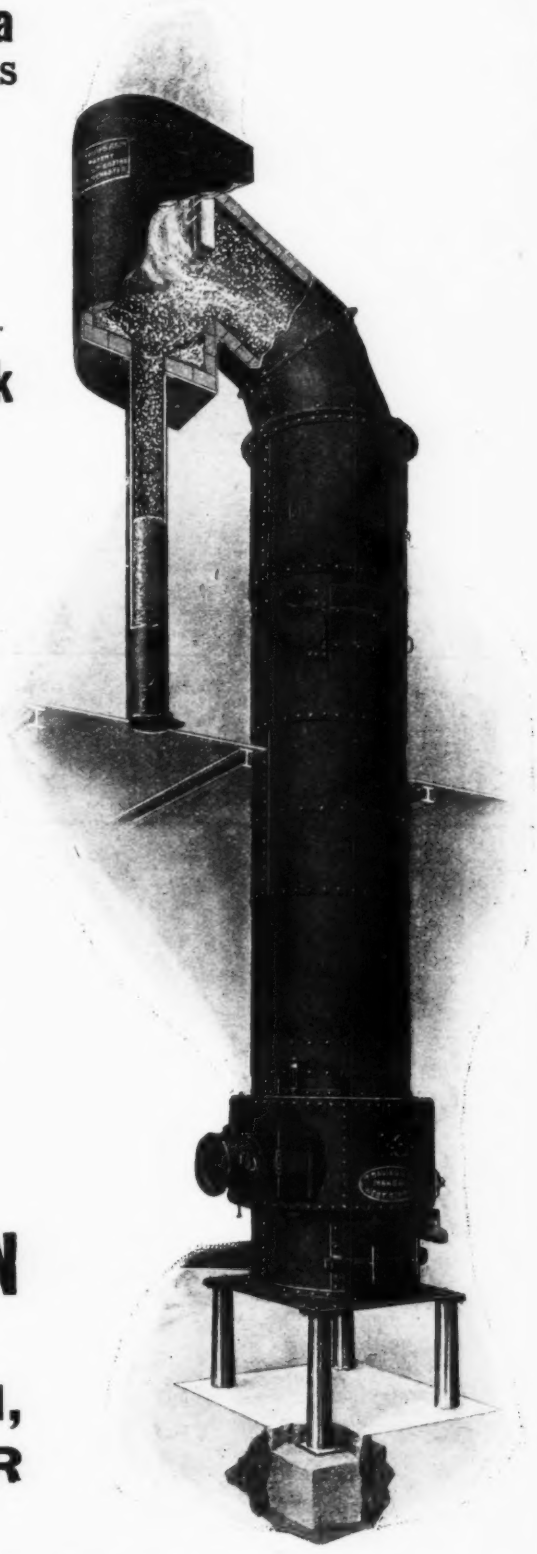

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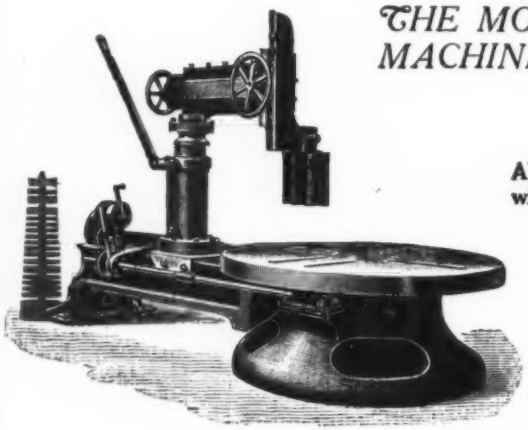

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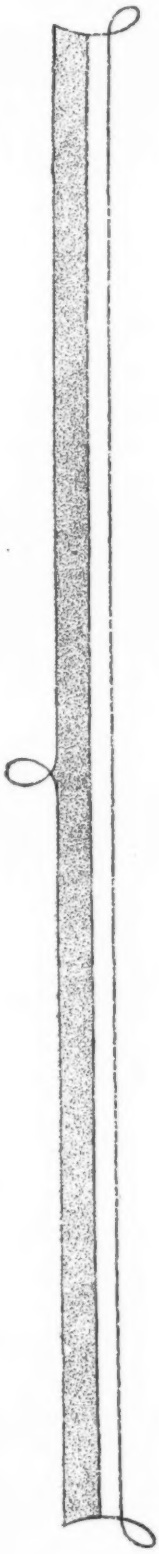

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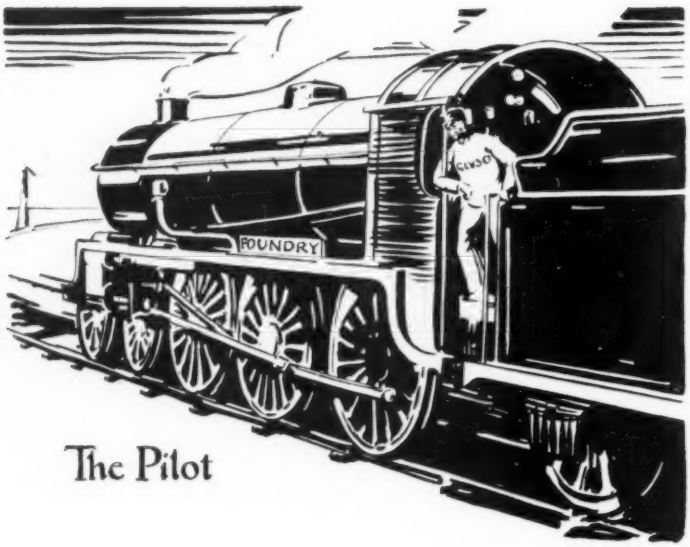

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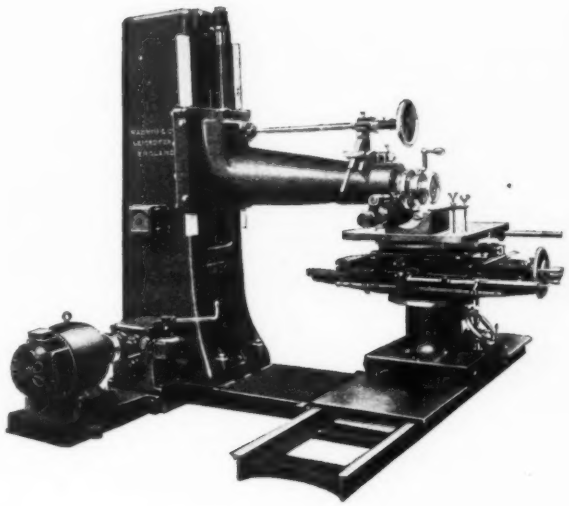

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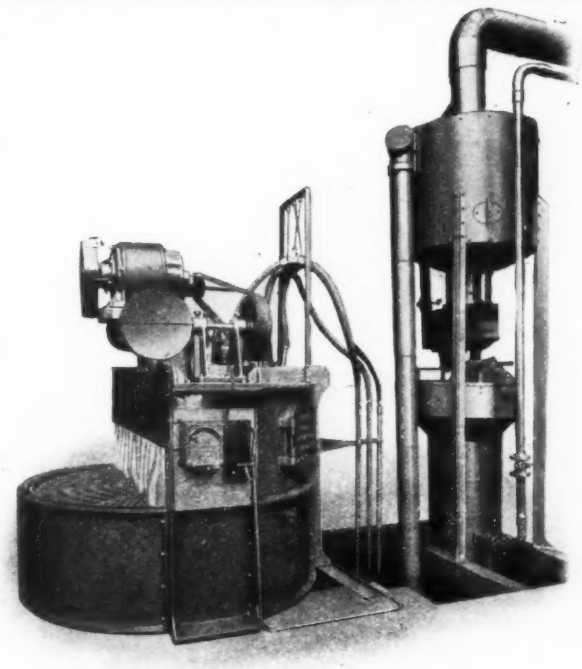

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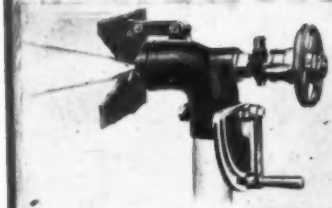

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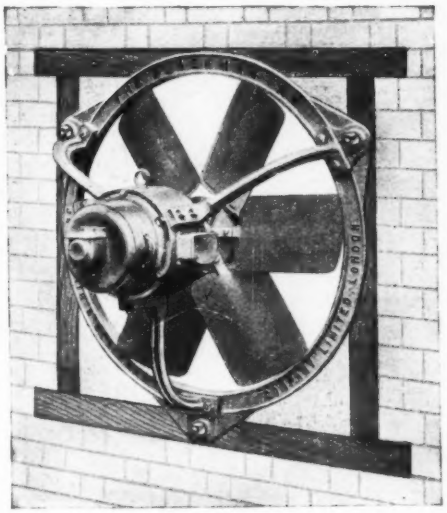

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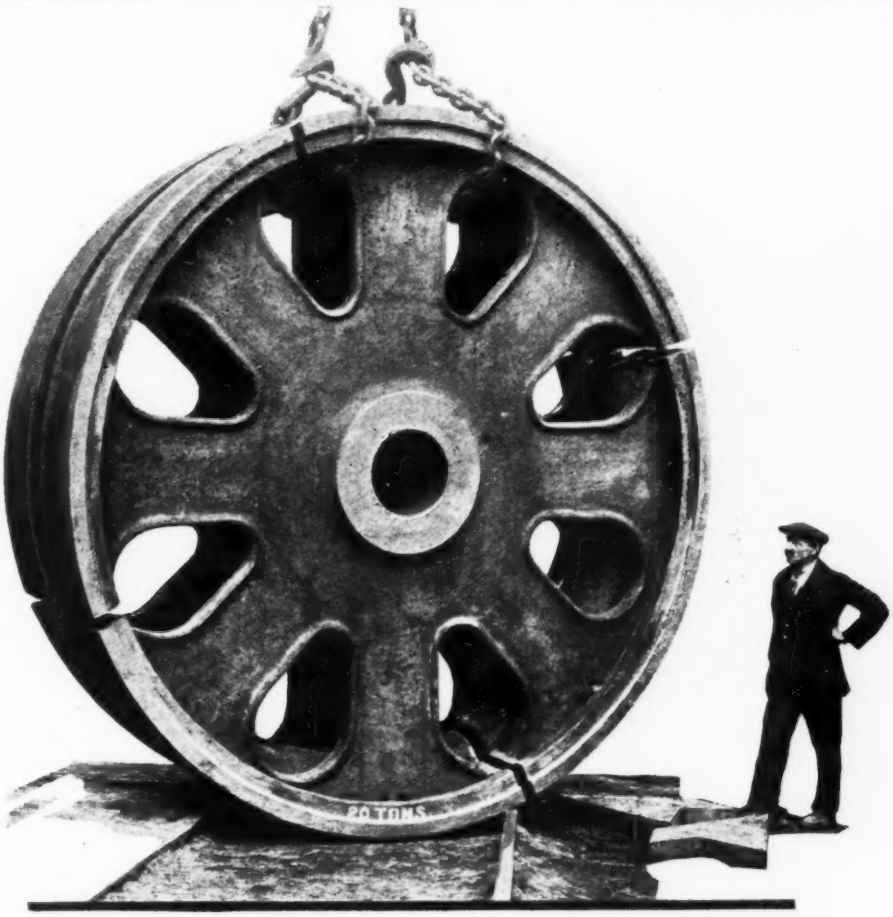

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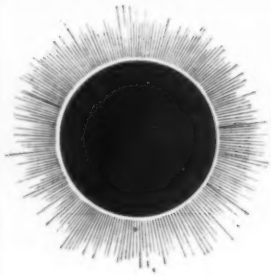

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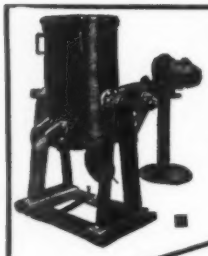

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Ross, J., & Co. (Lime Wharf) Ltd.	—
Salter, T. E., Ltd. ..	—
Sankey, J., & Sons, Ltd. ..	—
Scholefield, Richard ..	27
Settle Speakman & Co., Ltd.	—
Sheepbridge Coal & Iron Co., Ltd.	10
Sheffield Foundry Supplies Co.	—
Sheffield Metallurgical Laboratories	—
Shipping, Engineering & Machinery Exhibition (Olympia)	—
Shotts Iron Co., Ltd., The	—
Shropshire Iron Co., Ltd.	28&29
Simm, Martha	15
Smart, H. & H. E. ..	28
Smeeton, John A., Ltd. ..	—
Smith, Edward, Ltd. ..	—
Smooth-on Mfg. Co ..	28
Soc. Anonyme Silica ..	28
Spermolin, Ltd.	—
Stafford Coal & Iron Co., Ltd.	—
Standard Sand Co. ..	—
Stanton Ironworks Co., Ltd.	—
Staveley Coal & Iron Co., Ltd.	26
Steel Band Conveyor & Engg. Co., Ltd.	—
Steel Co. of Scotland Ltd.	556
Stella Gill Coke & Bye Products Co., Ltd. ..	—
Sterling Foundry Specialties, Ltd.	24
Swann, Ratcliffe & Co. ..	27
Tallis, E.	—
Tanks & Drums, Ltd. ..	—
Taylor & Farley	—
Team By-Product Co., Ltd.	553
Tennent, R. B., Ltd. ..	28
Thermit, Ltd.	—
Tilghman's Patent Sand Blast Co., Ltd.	9
Townley, E., & Son ..	—
Universal System of Machine Moulding & Machinery Co., Ltd.	—
Venton, H. W., Ltd. ..	—
Vereinigte Schmirgel-u. Maschinen-Fabriken, A.G.	—
Vickers, Thos.	14
Vono Co., Ltd., The ..	28
Wadkin & Co.	9
Walker, I. & I.	—
Wallwork, Hy., & Co. ..	—
Ward, Thos. W., Ltd. ..	—
Waring Bros.	—
Watson's (Metallurgists) Ltd. .. .. 14 &	553
Wellman Smith Owen Engg. Corporation, Ltd. ..	25
Welsh Navigation Steam Coal Co., Ltd.	—
West Midland Refining Co.	—
Westoby & Rawstron ..	4
Whittaker, W., & Sons, Ltd.	6
Whittingham, W. M., & Co.	—
Wilkins, Hy	—
Wilkinson, Pentley & Co., Ltd.	—
Wilkinson, Thos., & Co., Ltd.	—
Willson Goggles Inc. ..	—
Woolley, Jas., Sons & Co., Ltd.	—

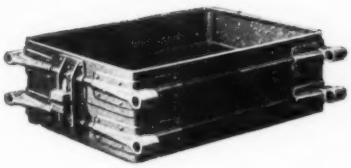
COMPLETE

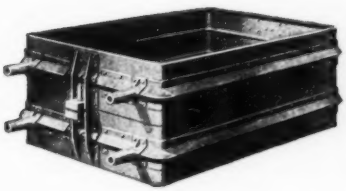
Foundry Equipment.

Telegrams: "LADLES" MANCHESTER
Telephone: "No. 2297 CENTRAL" MANCHESTER.

JAMES EVANS & Co. BRITANNIA WORKS,
BLACKFRIARS, MANCHESTER.

Sterling





In every class of Foundry and in every Moulding Box service Sterling Boxes soon show their marked superiority, not only in the better quality of work produced but also in increased output per man per hour.

Cast-iron Boxes are excessively heavy, and liable to break at any moment. Boxes made from sheet metal are too flimsy to stand up to the heavy duties of general foundry service.

There is only one remedy . . . the Sterling Rolled Steel Box, with the solid centre reinforcing rib and two stiff sand-retaining ledges. They are light, strong, rigid, accurately made on up-to-date machinery. Cannot crack or break. Cannot distort or get out of truth.

Send your next Moulding Box enquiry to the leading Moulding Box Manufacturers.

WHEREVER CASTINGS ARE MADE

STERLING BOXES

WILL HELP TO MAKE THEM

BETTER & CHEAPER

STERLING FOUNDRY SPECIALTIES LTD.
BEDFORD

London Office: 13, VICTORIA STREET, S.W.1.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	53	10	0
Three months	54	3	9
Electrolytic	59	10	0
Tough	57	0	0
Best selected	57	10	0
Sheets	84	0	0
India	69	5	0
Wire bars	60	0	0
Do. July	60	0	0
Do. August	60	0	0
Ingot bars	60	0	0
H.C. wire rods	64	10	0
Off. av. cash, May 54	11	10	7/32
Do. 3 mths. May 55	3	6	27/32
Do.,Sttlmnt. May 54	12	0	9/16
Do., Electro, May 61	1	5	9/16
Do., B.S., May 59	12	6	
Aver. spot price copper, May 54	11	10	1/2
Do.,wire bars, May 61	5	4	
Solid drawn tubes		12	1/2d.
Brazed tubes		12	1/2d.
Wire		9	1/2d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld.	7 1/2d.
Sheets to 10 w.g.	9 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8 1/2d.

TIN.

	£	s.	d.
Standard cash	297	15	0
Three months	285	15	0
English	294	10	0
Bars	295	10	0
Straits	306	10	0
Australian	305	10	0
Eastern	293	5	0
Banca	302	10	0
Off.avr. cash,May 295	0	11	25/32
Do.,3 mths., May 286	12	9	25/32
Do., Sttlmt. May 294	19	9	9/16
Aver. spot, May 295	0	11	1/2

SPELTER.

	£	s.	d.
Ordinary	28	7	6
Remelted	26	10	0
Hard	22	0	0
Electro 99.9	31	5	0
English	28	15	0
India	24	10	0
Zinc dust	37	0	0
Zinc ashes	10	0	0
Off. aver., May	29	1	7 1/2
Aver., spot, May	29	0	8

LEAD.

	£	s.	d.
Soft foreign ppt.	23	17	6
English	25	10	0
Off. average, May	25	5	9
Average spot, May	25	1	1

ZINC SHEET, &c.

Zinc sheets, English	38	0	0
Do. V.M. ex whf.	35	0	0
Rods	42	0	0
Boiler plates	34	10	0
Battery plates	34	0	0

ANTIMONY.

Special brands,Eng.	74	10	0
Chinese	53	0	0
Crude	39	0	0

QUICKSILVER.

Quicksilver	21	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—			
25%	9	0	0
45/50%	12	7	6
75%	19	5	0
Ferro-vanadium—			
35/40%	14/3 lb. va.		
Ferro-molybdenum—			
70/75% c. free	5/- lb.		
Ferro-titanium—			
23/25% carbonless	11 1/2d.		
Ferro-phosphorus, 20/25%,	£17	15	0
Ferro-tungsten—			
80/85%, c. fr.	1/5 lb.		
Tungsten metal powder—			
98/99%	1/8 1/2 lb.		
Ferro-chrome			
2/4% car.	£33	15	0
4/6% car.	£23	15	0
6/8% car.	£23	0	0
8/10% car.	£22	12	6
Ferro-chrome—			
Max. 2% car.	£36	10	0
Max. 1% car.	£42	5	0
Max.0.70% car.	£54	0	0
70%, carbonless	1/5 lb.		
Nickel—99%, cubes or pellets	£170		
Ferro-cobalt	9/3 lb.		
Aluminium 98/99%	£105		
Metallic Chromium—			
96/98%	3/3 lb.		
Ferro-manganese (net)—			
76/80%, loose	£12	0	0
76/80%, packed	£13	0	0
76/80%, export	£11	15	0
Metallic manganese—			
94/96%, carbonless	1/10 lb.		
Per ton unless otherwise stated.			

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0
Per lb. net, d/d buyers' works.		
Extras—		
Rounds and squares 3 in. and over	4d. lb.	
Rounds and squares under 1/4 in. to 1/4 in.	3d. lb.	
Do., under 1/4 in. to 1/16 in.	1/- lb.	
Flats, 1/2 in. × 1/4 in. to under 1 in. × 3/4 in.	3d. lb.	
Do. under 1/2 in. × 1/4 in.	1/- lb.	
Bevels of approved sizes and sections	6d. lb.	
Bars cut to length 10% extra.		
Scrap from high-speed tool steel—		
Scrap pieces	3d.	
Turnings and swarf	1d.	
Per lb. net, d/d steel makers' works.		

SCRAP.

	£	s.	d.
South Wales—			
Hvy. steel	3 3 6 to 3	5	0
Bundled steel & shrngs.	2 15 0 to 2	17	6
Mixed iron & steel	2 17 6 to 2	18	6
Heavy cast iron	3 3 6 to 3	6	0
Good machinery for foundries	3 5 0 to 3	7	6
Cleveland—			
Heavy steel	2	17	6
Steel turnings	2	2	6
Cast iron borings	2	1	0
Heavy forge	3	15	0
Bushelled scrap	3	5	0
Cast-iron scrap	3 3 0 to 3	10	0
Lancashire—			
Cast-iron scrap	3 7 6 to 3	10	0
Hvy. wrought	3	2	6
Steel turnings	2	0	0
London — Merchants' buying prices delivered yard.			
Copper (clean)	47	0	0
Brass (clean)	38	0	0
Lead (less usual draft)	21	0	0
Tea lead	17	10	0
Zinc	18	0	0
New aluminium cuttings	82	0	0
Braziery copper	44	0	0
Gunmetal	46	0	0
Hollow pewter	180	0	0
Shaped black pewter	140	0	0

PIG-IRON

(f.o.t. unless otherwise stated).

N.E. Coast—	
Foundry No. 1	72/6
Foundry No. 3	70/-
Foundry No. 4	69/-
Forge No. 4	68/6
Hematite No. 1	78/-
Hematite M/Nos.	77/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	88/-
,, d/d Birm.	95/- to 97/6
Midlands—	
Staffs. common*	—
,, No. 4 forge	—
,, No. 3 fdry.	68/- to 70/-
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	—
,, fdry. No. 3	65/-
Derbyshire forge	—
,, fdry. No. 3	70/-
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	79/-
Hem. M/Nos.	81/6
Sheffield (d/d district)—	
Derby forge	72/6
,, fdry. No. 3	74/6
Lincs. forge	—
,, fdry. No. 3	77/6
E.C. hematite	90/-
W.C. hematite	94/-
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	78/-
Northants foundry No. 3	—
Dalzell, No. 3	105/- to 110/-
Summerlee, No. 3	96/- to 102/6
Glengarnock,No. 3	96/- to 102/6
Gartsherrie,No. 3	96/- to 102/6
Monkland, No. 3	96/- to 102/6
Coltness, No. 3	96/- to 102/6
Shotts, No. 3	96/- to 102/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.	10	10	0 to 11	0	0	
Angles			—			
Tees to 3 united ins.			—			
Nut and bolt iron			—			
Hoops			14	10	0	
Marked bars (Staffs.) f.o.t.			13	10	0	
Gas strip			12	10	0	
Bolts and nuts 3/4 in. × 4 in.			15	5	0	
Steel—						
Ship plates	8	2 6	to 8	7	6	
Boiler plts.			11	0	0	
Chequer plts.			10	5	0	
Angles			7	12	6	
Tees			8	12	6	
Joists			7	12	6	
Rounds and squares 3 in. to 5 1/2 ins.			7	15	0	
Rounds under 3 in. to 3/8 in. (Untested)	8	0	0 and upwards			
Flats, over 5 in. wide and up			9	2	6	
Flats, 5in. to 1 1/2 in.			8	2	6	
Rails, heavy			8	2	6	
Fishplates			10	12	0	
Hoops (Staffs.)			10	10	0	
Black sheets, 24g.			11	7	6	
Galv. cor. shts, 24g.			14	10	0	
Galv. fencing wire 8g. plain			12	10	0	
Billets, soft	6	10 0	to 7	0	0	
Billets, hard			—			
Sheet bars			6	5	0	
Tin bars d/d			6	5	0	

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	2 1/4
Sheet to 10 w.g.	1	2 3/4
Wire	1	3 1/4
Rods	1	2 3/4
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3 1/2 to 1/9 1/2
To 15 in. wide	1/3 1/2 to 1/9 1/2
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4 1/2 to 1/10 1/2
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5 1/2
Ingots rolled to spoon size	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON & STEEL

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	18.00
No. 2 foundry, Birm.	18.00
Basic	20.75
Bessemer	20.76
Malleable	19.76
Grey forge	19.26
Ferro-mang. 80% d/d	90.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	33.50
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.86
Skelp, grooved steel	1.80
Skelp, sheared steel	1.80
Steel hoops	2.30
Sheets, black, No. 24	3.00
Sheets, galv., No. 24	3.85
Sheets, blue an'l'd, 9 & 10	2.25
Wire nails	2.50
Plain wire	2.40
Barbed wire, galv.	3.20
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham & North.	
,, foundry	—
,, furnace	16/-
Other Districts, foundry	—
,, ,, furnace (basis)	12/6 to 15/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20×14, box	19/-
,,	28×20, ,,	38/-
,,	20×10, ,,	—
,,	18 3/4×14, ,,	—
C.W.	20×14, ,,	17/10 1/2
,,	28×20, ,,	—
,,	20×10, ,,	—
,,	18 3/4×14, ,,	—

Terneplates 28 × 20, — per box basis f.o.b.

SWEDISH IRON.

Bars,hammered	£18/10 to £19/0
Rolled Ord.	£15/5/0 to £15/15
Nail rods	£15 12 6 to £16 0 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron all f.o.b. Gothenburg.	£6 0 0 to £6 10 0

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes.	*Fittings*
Gas ..	67½% ..	45%
Water ..	62½% ..	40%
Steam ..	57½% ..	35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.	
June 23	54	2	6	inc. 7/6
„ 24	53	17	6	dec. 5/-
„ 27	53	15	0	„ 2/6
„ 28	53	13	9	„ 1/3
„ 29	53	10	0	„ 3/9

Electrolytic Copper.

	£	s.	d.	
June 23	59	15	0	No change
„ 24	59	15	0	„ „
„ 27	59	15	0	„ „
„ 28	59	10	0	dec. 5/-
„ 29	59	10	0	No change

Standard Tin (Cash).

	£	s.	d.	
June 23	300	15	0	inc. 45/-
„ 24	297	15	0	dec. 60/-
„ 27	300	15	0	inc. 60/-
„ 28	296	5	0	dec. 90/-
„ 29	297	15	0	inc. 30/-

Tin (English ingots).

	£	s.	d.	
June 23	297	15	0	inc. 55/-
„ 24	294	15	0	dec. 60/-
„ 27	297	15	0	inc. 60/-
„ 28	293	10	0	dec. 85/-
„ 29	294	10	0	inc. 20/-

Zinc Sheets (English).

	£	s.	d.	
June 23	38	0	0	No change
„ 24	38	0	0	„ „
„ 27	38	0	0	„ „
„ 28	38	0	0	„ „
„ 29	38	0	0	„ „

Spelter (ordinary).

	£	s.	d.	
June 23	28	6	3	dec. 2/6
„ 24	28	5	0	„ 1/3
„ 27	28	8	9	inc. 3/9
„ 28	28	3	9	dec. 5/-
„ 29	28	7	6	inc. 3/9

Lead (English).

	£	s.	d.	
June 23	25	15	0	inc. 5/-
„ 24	25	15	0	No change
„ 27	25	15	0	„ „
„ 28	25	10	0	dec. 5/-
„ 29	25	10	0	No change

AVERAGE MONTHLY PRICES OF IRON HOOPS.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 5 0	6 10 0	6 3 4
1897	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0
1898	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	7 0 0	6 11 8	
1899	7 0 0	7 0 0	7 0 0	7 0 0	7 12 6	10 12 6	8 12 6	8 12 6	8 12 6	9 2 6	9 7 6	9 17 6	8 2 6
1900	9 17 6	10 7 6	10 7 6	10 7 0	10 12 6	7 12 6	10 12 6	10 12 6	10 12 6	9 17 6	9 2 6	9 2 6	10 3 9
1901	9 2 6	8 2 6	8 2 6	7 12 6	7 12 6	7 12 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 11 8
1902	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1903	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1904	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1905	6 17 6	7 0 0	7 0 0	7 0 6	7 0 0	7 0 0	7 2 6	7 2 6	7 2 6	7 7 6	7 0 0	7 7 6	7 1 8
1906	7 10 0	7 17 6	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 7 6	7 15 10
1907	8 7 6	8 7 6	8 7 6	8 7 0	8 7 6	8 7 6	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 0 0	8 7 1
1908	8 0 0	7 10 0	7 10 0	7 10 6	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 6 8
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0
1910	7 1 10½	7 6 3	7 7 6	7 7 0	7 7 6	7 7 6	7 7 6	7 7 6	7 7 6	7 6 3	7 5 0	7 6 5½	
1911	7 5 0	7 5 0	7 5 0	7 5 6	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 8 9	7 10 0	7 10 0	7 6 1½
1912	7 12 6	7 12 6	7 12 6	7 15 0	7 15 0	8 2 6	8 2 6	8 2 6	8 12 6	8 12 6	8 12 6	8 15 0	8 2 3½
1913	8 17 6	8 17 6	8 17 6	8 17 0	8 17 6	8 17 6	8 17 6	8 7 6	8 7 6	8 7 6	8 7 6	7 17 6	8 12 6
1914	7 17 6	7 17 6	7 17 6	7 13 9	7 12 6	7 12 6	7 12 6	9 2 6	9 2 6	9 2 6	9 2 6	9 2 6	8 6 4½
1915	9 3 6	9 18 1	10 7 6	10 16 6	10 17 6	13 2 6	13 2 6	13 2 6	13 7 6	14 2 6	15 2 6	15 18 6	12 10 1½
1916	17 2 6	17 2 6	17 2 6	17 6 3	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 6 1½
1917	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1918	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1919	17 2 6	17 2 6	17 2 6	17 2 6	24 6 3	24 6 3	24 6 3	25 9 0	26 7 6	26 7 6	26 7 6	26 17 4	22 14 9
1920	28 0 0	28 12 6	33 15 0	35 5 0	35 15 10	38 17 6	38 17 6	38 17 6	38 17 6	38 17 6	36 17 6	36 17 6	35 14 9
1921	29 1 3	23 5 0	21 12 6	20 0 0	20 0 0	20 0 0	17 5 0	15 0 0	14 4 0	13 15 0	13 10 0	12 18 0	17 5 10
1922	16 5 0	15 13 9	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	18 4 6½
1923	14 0 0	15 0 0	15 0 0	15 0 0	15 6 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 16 0	14 15 0	14 18 3½
1924	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 13 9	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 12 4½
1925	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1926	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1927	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	—	—	—	—	—	—	—	—

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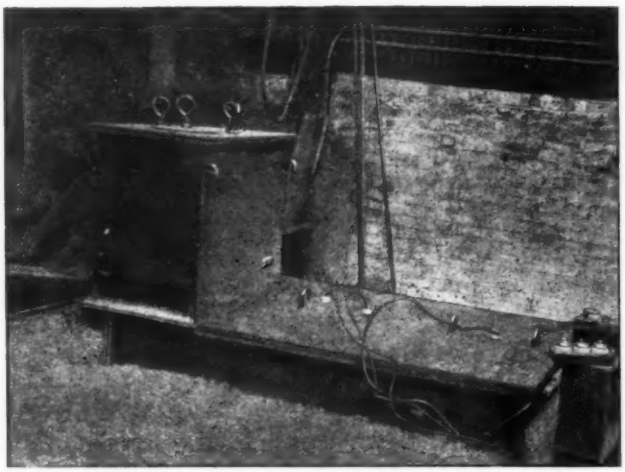

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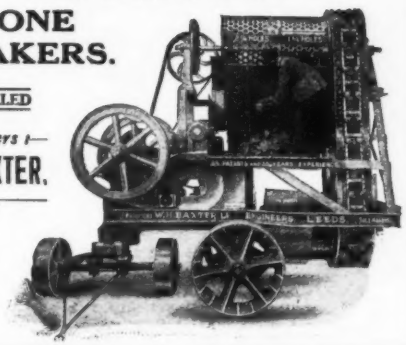

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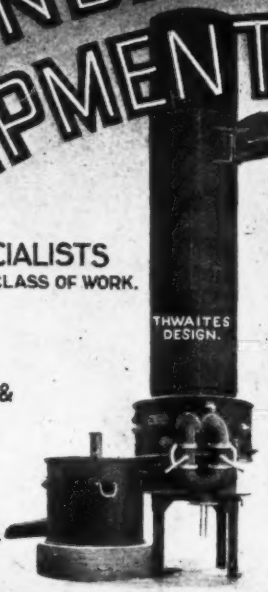

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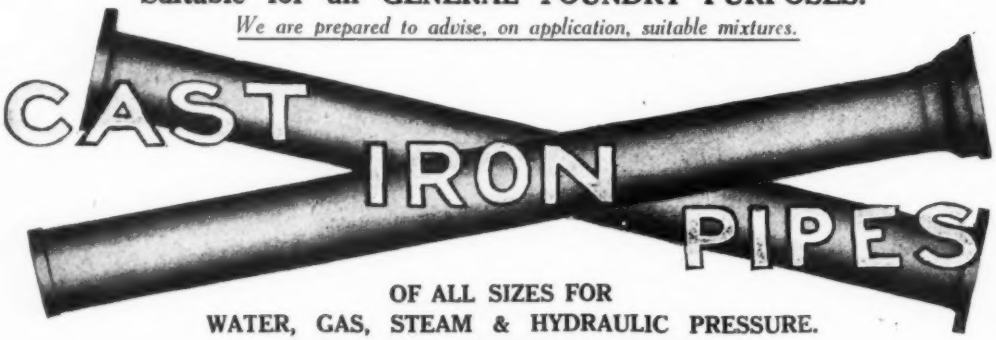

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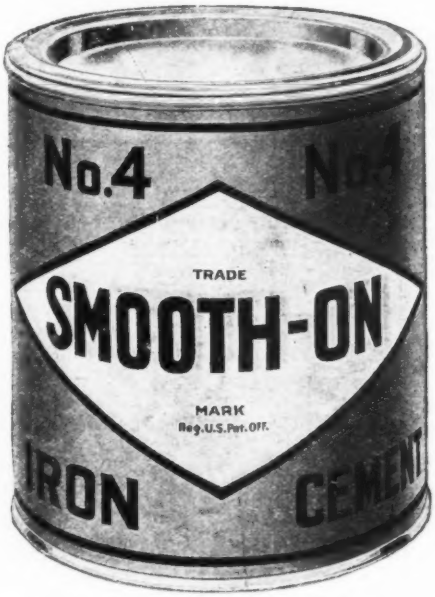

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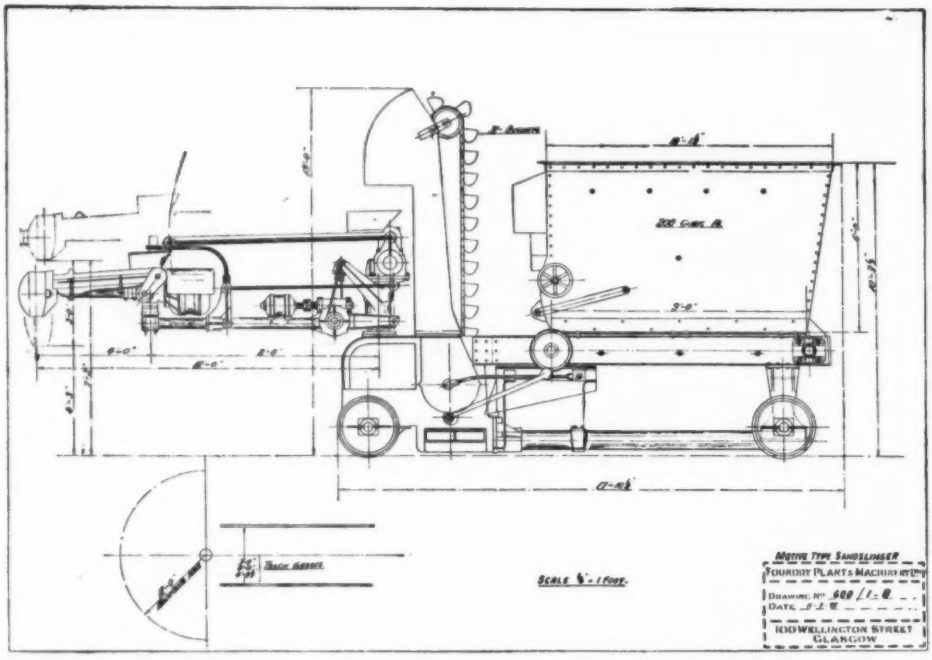
SANDSLINGER

The Jobbing Founders' Moulding Machine



MOTIVE TYPE SANDSLINGER

Ramming unit may be operated at 4 ft. 3 ins. to 7 ft. 3 ins. from floor level, and has a radius of 12 ft. from centre of track.

Impeller motor fitted is capable of ramming heaviest type of castings.

Machine travels at crane speed along foundry, and may be set to ram moulds on both sides of track with short travel, or on one side of track, with machine close to wall when long foundries are available.

Hopper carries 200 cub. ft. of sand, which is fed regularly by slat bottom to shaker riddle at boot of elevator.

Sand may be filled to hopper direct from foundry floor by grab bucket, or the machine can be run to a central sand treatment location at shake out and sand dumped direct from storage bins.

Machines of this type are actually ramming for 7¼ hours out of an 8-hour day.

Motors—Tractor, 15 B.H.P. Impeller, 12½ B.H.P. Elevator and Hopper Bottom, 7½ B.H.P. Arm Raising Gear, 1 B.H.P. Belt Conveyor, 1 B.H.P.

Power—Alternating or Direct Current equally convenient.

Will ram upwards of 100 tons of sand per day

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